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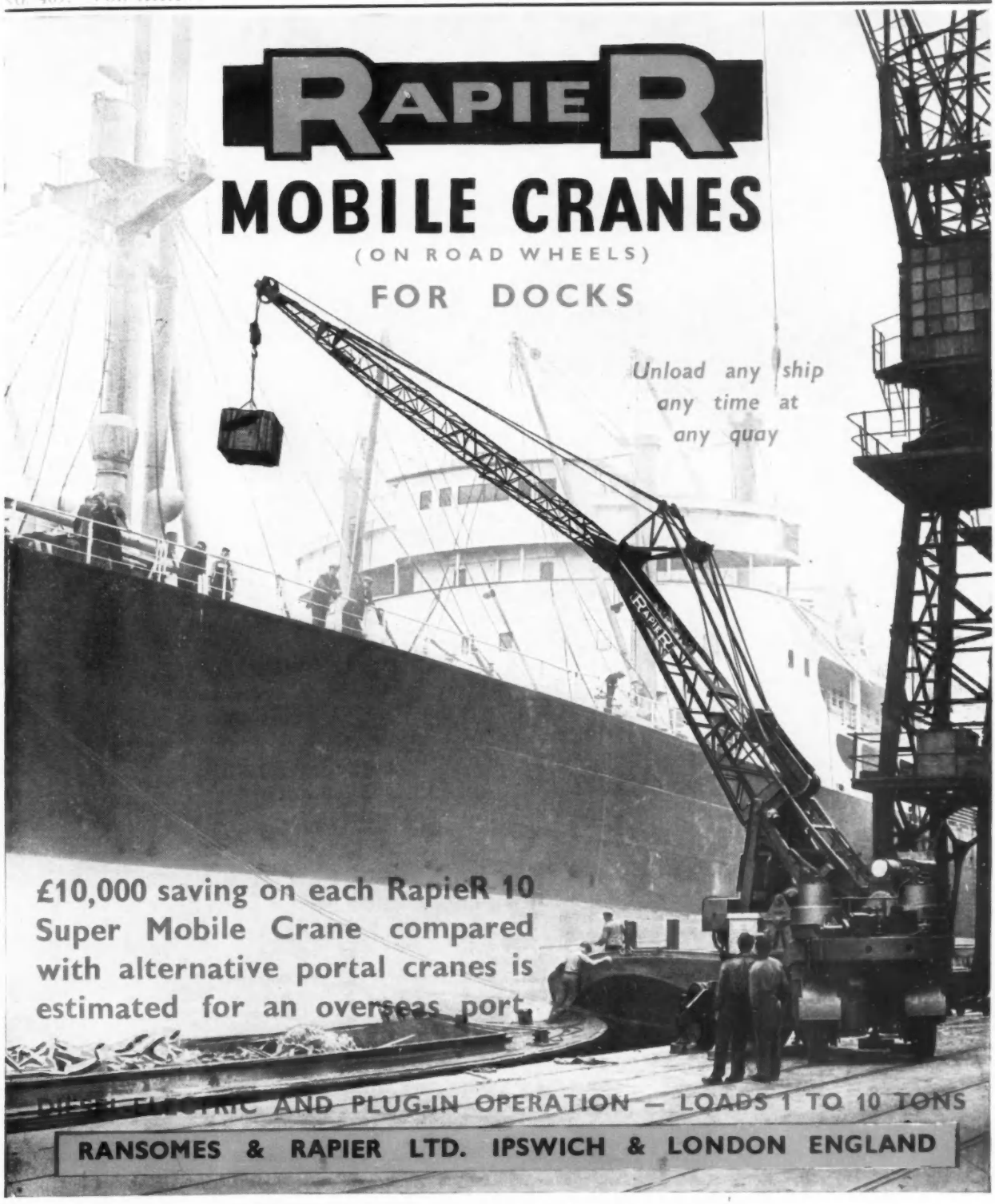
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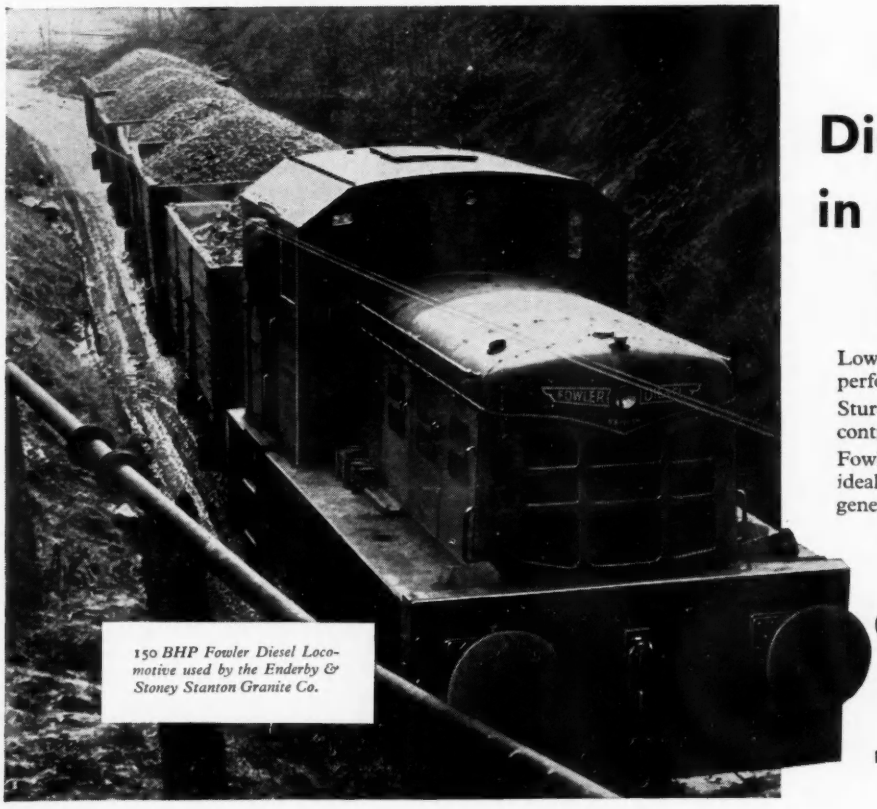

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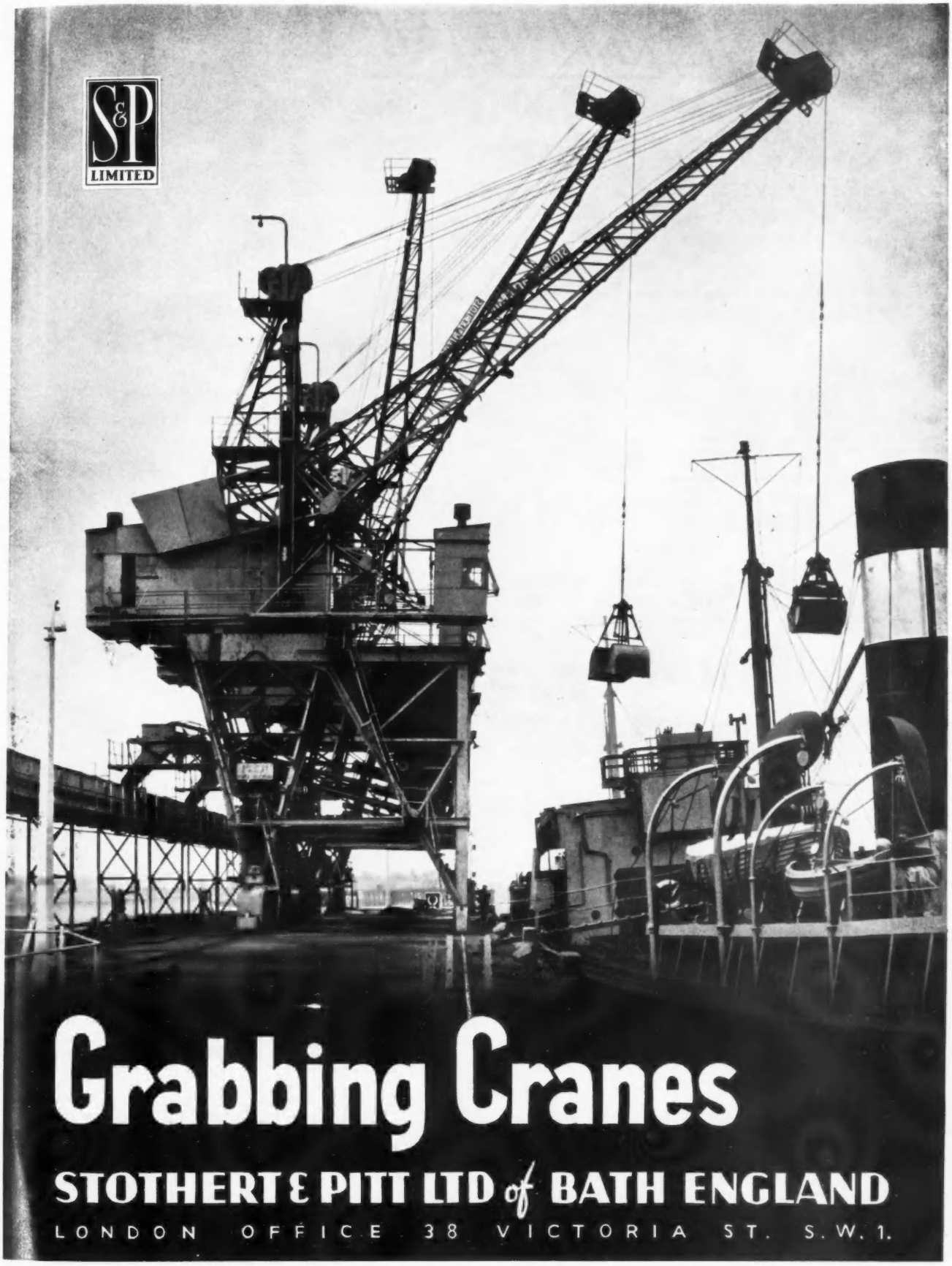
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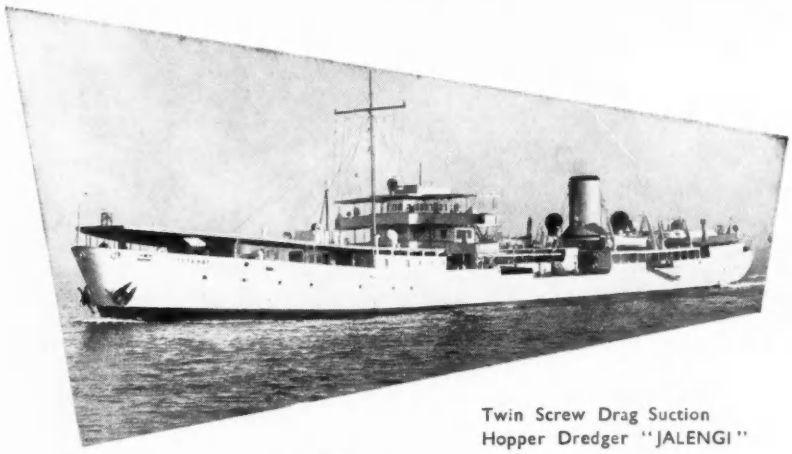

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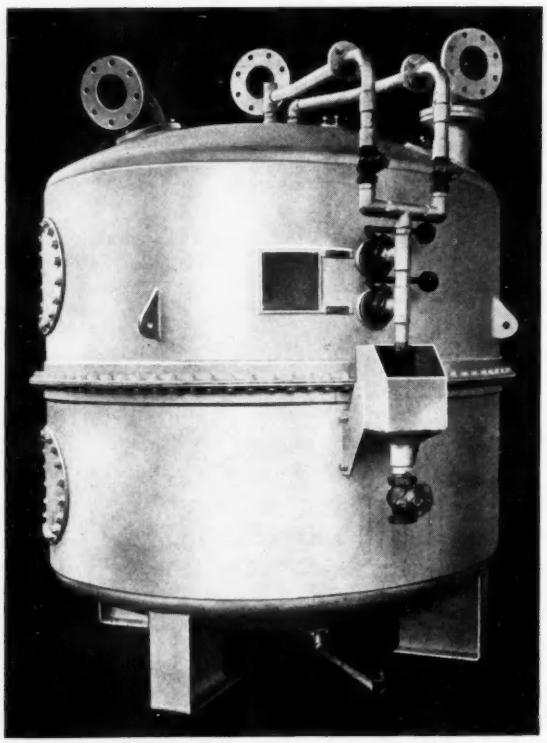

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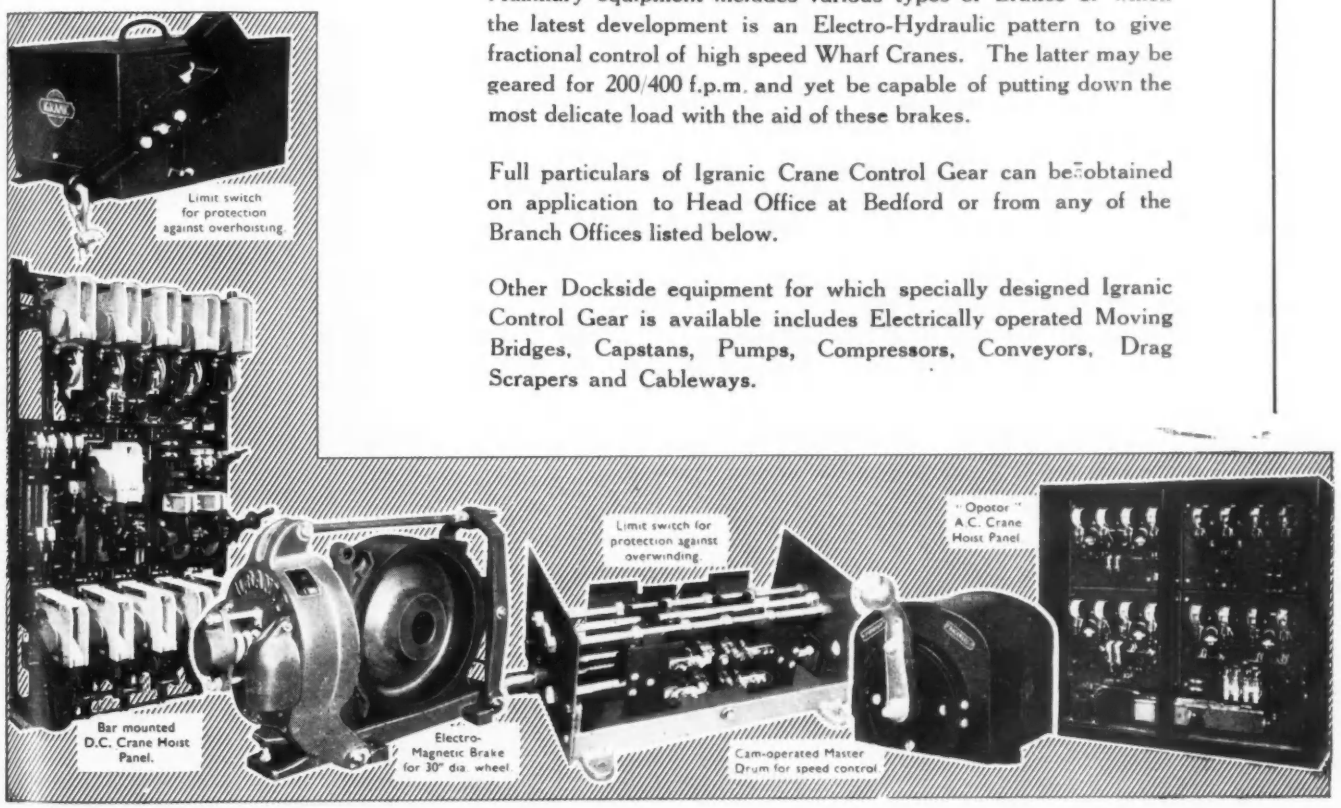
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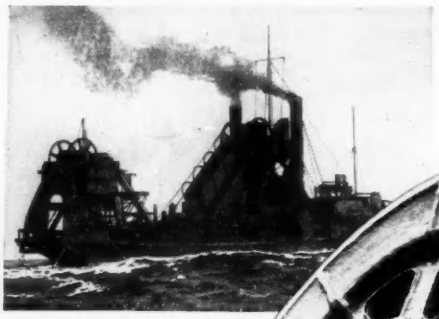

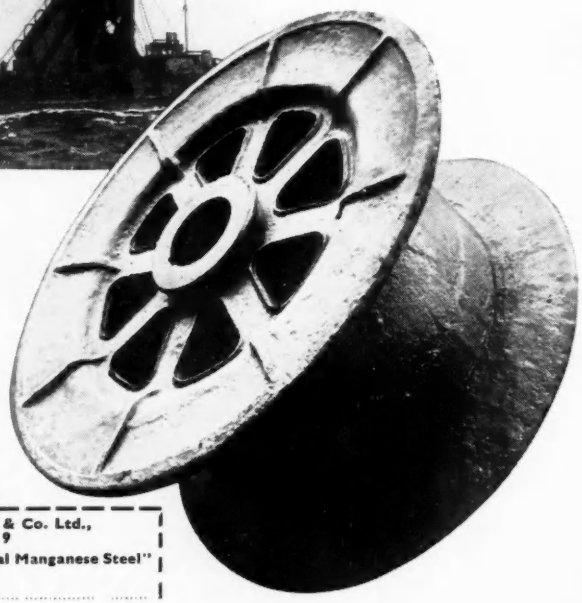

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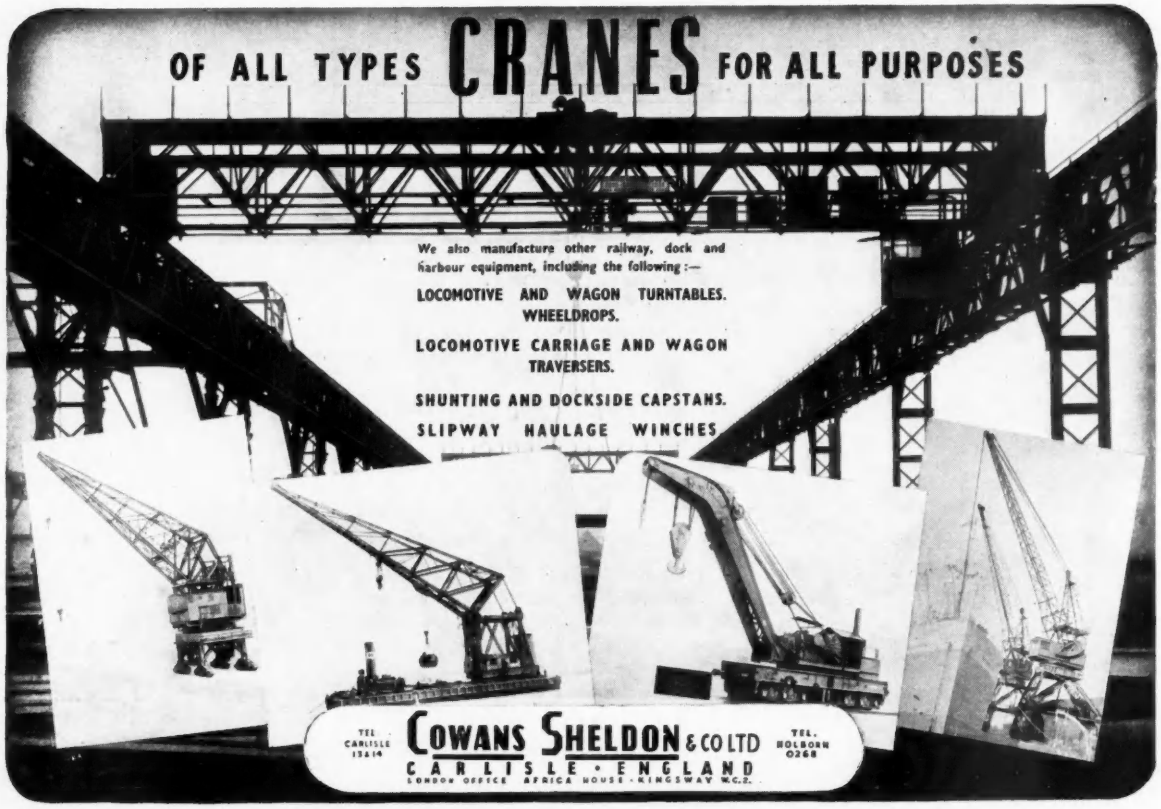

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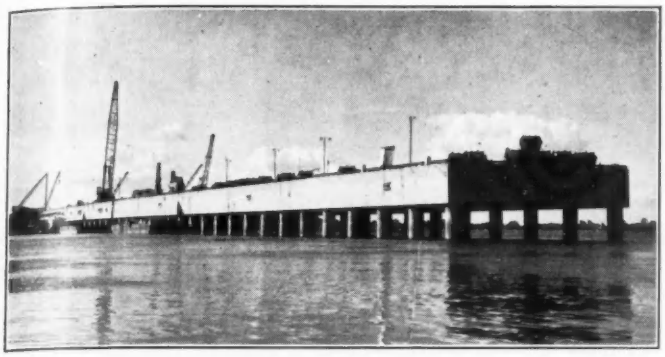
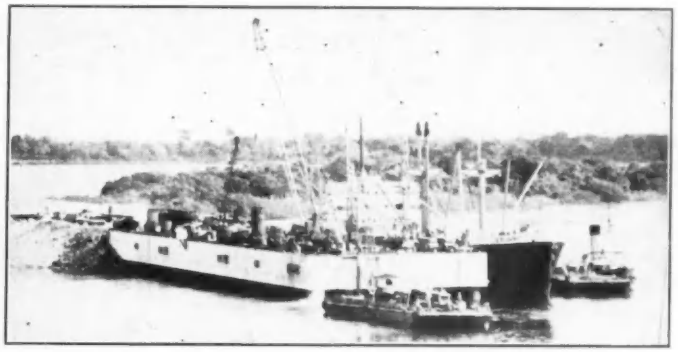
1. *Orinoco Mining Company's new ore and cargo handling dock on the Orinoco River, Venezuela. Composed of 3 units, this DeLong dock is 1,130 ft. long, 82 ft. wide, and 15 ft. deep.*

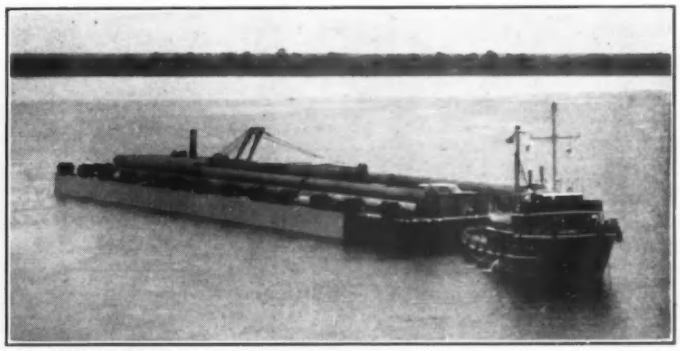


2. *A week after arrival at Orinoco River site, first dock section 376 ft. long berths ship, and unloading begins. Two additional units make this pier 1,130 ft. long.*



DeLong airjack transforms sea going dock-barge into ore and cargo pier !

3. *Dock sections were economically fabricated at an Orange, Texas shipyard where costs were carefully controlled. Then, dock barge was launched for towing to pier site.*



4. *Loaded dock section arriving at site on Orinoco River, Venezuela, after being towed across 3,000 miles of ocean. Dock carried caissons, crane, Airjacks, compressors, generators, and all other installation gear.*

Cuts time, costs ! Field work is practically eliminated in dock construction, due to the development of the patented DeLong Airjack. This new technique of dock construction speeds installation, cuts cost.

The DeLong Airjacks, which are the key to the whole transformation of barge to pier, enable the dock to 'climb' the steel columns, or caissons, to required elevation. After the self-lifting operation, caissons are driven to refusal for permanent installations. Caissons are welded to deck and cut off flush ; then filled with concrete or sand and tops closed with welded cover plate.

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The DeLong Airjack can cut time and costs in the construction of offshore oil well drilling platforms, portable and permanent piers, and many other types of installations. A DeLong dock can be erected and, after having served its purpose, jacked back to water level and towed to a new location.

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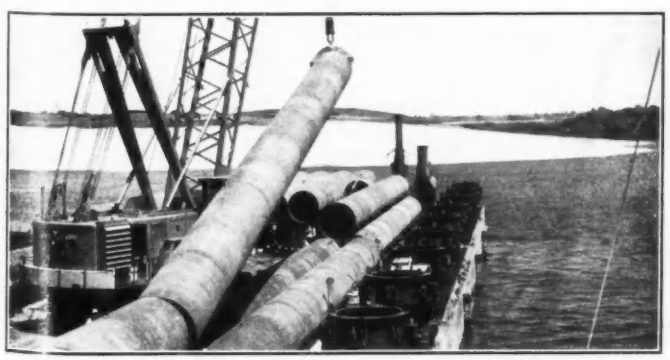
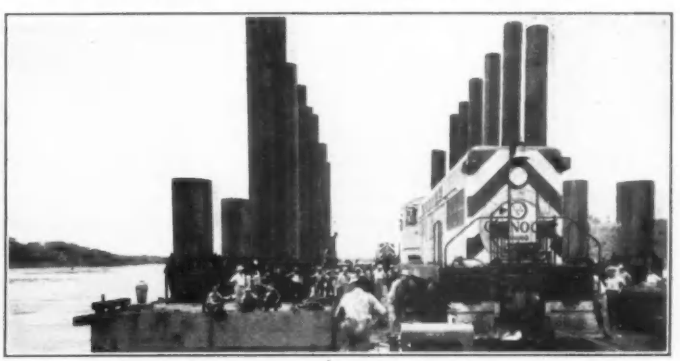
5. *Crane placing 6 ft. diam., 100 ft. long steel caissons in wells fitted with Airjacks. Crane, Airjacks and other equipment were later transferred to second and third sections for erection purposes.*



6. *Caissons held in position by Airjacks until dock barge is jockeyed into final position. Caissons are then dropped to river bottom and DeLong Airjacks lift dock to final elevation. Control is so precise, height of dock can be regulated to 1/32 of an inch.*



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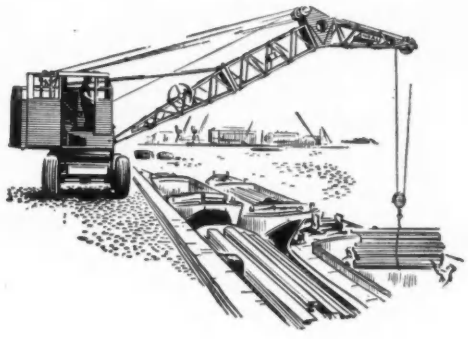

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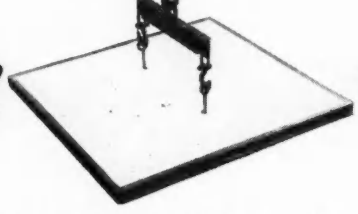
Stelcon  **'RAFT' FLOORS**

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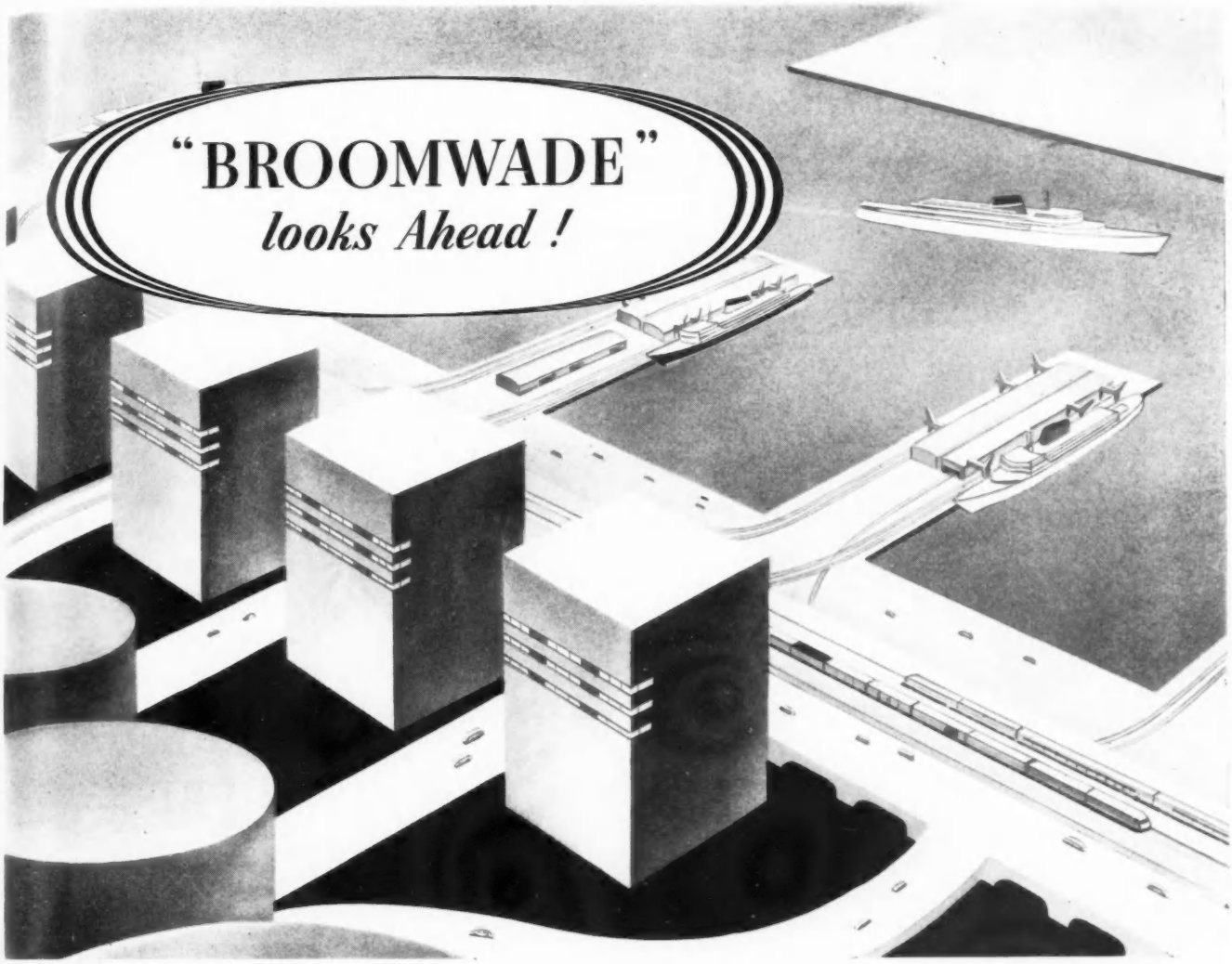

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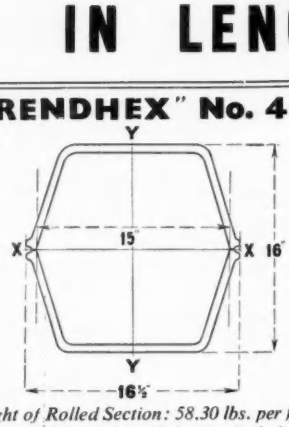

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Weight of Complete Column (including weld): 117.75 lbs. per ft.

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XX	469.26	4.69	72.2
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EASE IN HANDLING. In relation to their strength these columns are light in weight and easily transportable

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DOCK & HARBOUR CONSTRUCTION. Cargo Fleet "Rendhex" Foundation Columns are particularly adapted for use where piling construction is required. The properties of these Columns are superior for the work for which they are designed as compared with other methods of piling construction.

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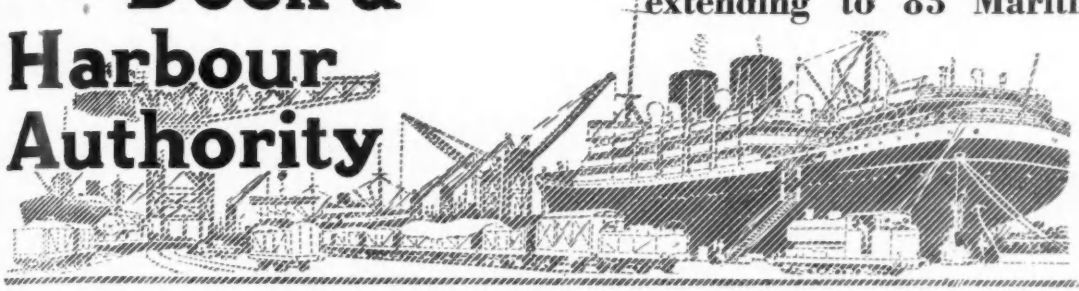


No. 409

Vol. XXXV.

NOVEMBER, 1954

Monthly 2s. 0d.

Editorial Comments

Ship Fires in Ports.

The problems of ship fires in ports has increasingly exercised the minds of Harbour and Fire Authorities lately, and has formed the subject of recent articles in this Journal. In connection with these, we have received the annual 1953-1954 report to the fire committee of the Bootle Borough Council, whose fire brigade has had exceptional experience of both major and minor outbreaks of fire in the Liverpool Docks.

In this report, the question of state legislation for the enforcement of fire prevention regulations, is strongly advocated, as the result of the alarming increase of ship fires, and of the findings of the Court of Enquiry into the " Empress of Canada " Disaster. The necessity for immediate and close liaison between all Port and Fire Authorities is also stressed, with special reference to the availability of expert advice as to a vessel's stability during fire-fighting operations.

It is during these operations, however, that one of the chief difficulties appears to be the complex question of the trapping of quantities of loose water at high levels in a vessel. In cases of fires which are more or less localised, and where visual evidence of such water is possible, this is capable of being dealt with by small pumps such as those recently adopted by the Southampton Fire Department, and which are described on a following page.

In large passenger vessels, and especially in those cases of fires in which isolation of the burning compartments has become impossible owing to the rapid spread of the conflagration, the final destination of the water pumped into the vessel remains unknown, and therefore the important factor of stability, in spite of the presence of experts, and data relating to that factor, as pertaining to the vessel " previous " to the fire, becomes almost valueless.

The principal safety measures towards reductions in major fires would therefore appear to be the putting into force by the Authorities concerned, of more rigorous fire prevention activities, to be enforced if necessary by the introduction of legislation for that purpose.

United Kingdom Ship Repair Facilities.

The traditional method by which Great Britain's adversaries endeavour to bring this country to her knees is by trying, *inter alia*, to starve her out. Twice in the past forty years our position as regards food and essential materials has been brought by enemy action to a critical state, and one of the major bottle-necks has been caused by the lack of adequate facilities for ship repair. It is no exaggeration to say that but for the tremendous efforts made by the ship repairing industry during the last two wars this country might have been forced to surrender.

Such considerations give added point to the review of this industry which has recently been given by Mr. H. J. A. Silley in his Presidential Address to the Institute of Marine Engineers, abstracts of which appear on another page.

Mr. Silley deals with the past and present state of ship repairing, and gives timely warning that this country is falling behind its competitors. The shortage of drydocks is emphasised, as are the difficulties of building new drydocks under present conditions of heavy taxation. It would seem that there is a strong case for Government assistance both in subsidies and in more generous taxation relief on the cost of constructing drydocks. Such a change of heart on the part of the Chancellor of the Exchequer would serve a double purpose, enabling this country to compete more readily with Continental repairers, and providing an essential ingredient in Civil Defence.

Dock Strikes and Labour Indiscipline.

The final report of the Court of Inquiry into the recent dispute in the London Docks states that the issue involved was " a narrow one which, in our judgment, is or should be capable of satisfactory resolution under the existing machinery without difficulty."

This aspect of the strike was emphasised in the editorial columns of our October issue, where it was stated: " Whatever the causes of the trouble, its scale and persistence are beginning to constitute a national danger. There is machinery for settling disputes in the port industry. Why is it not properly used? "

The Inquiry report touches on this matter in two ways. It states, firstly, that both the overtime ban and the withdrawal of labour were breaches, by the National Amalgamated Stevedores and Dockers, of the National Joint Council Constitution and machinery, and secondly, that to attempt to understand how that happened, it is necessary to study past history.

Amplifying the second point, the report remarks that the Leggatt Report of 1951 upon unofficial stoppages in the London Docks drew attention to the disorganising activities of the unofficial body of workpeople known as the Portworkers Committee. " That committee," the present report states, " still exists and we have no reason to suppose that its character and activities and the character and activities of its adherents have undergone any appreciable change."

The present report also states: " Given the existence of disaffected persons and bodies of the kind we have mentioned, it is not to be doubted that they would seize upon the existence of such an issue as the overtime ban in order to aggravate the dispute and persuade workers to the view they now undoubtedly hold; and, when the strike began, to spread it."

In view of this statement, some reference to the subsidiary strikes and dislocation which followed the calling off of the main strike on 31st October will be pertinent. Some 44,000 dockers in various ports returned to work on November 1st, twenty-nine days after their strike had started. They went back on overtime terms freely offered to them by employers and endorsed by responsible union officials seven months previously, yet, because it was agreed that, during discussions, no disciplinary action would be taken against men in London not willing to work overtime (a position which had already obtained for many months), Victor Marney, the man who had become known as the unofficial strike leader, claimed for the men " a glorious victory."

With this attitude of mind among the workpeople, another unofficial strike started in the Port of London within a few hours of the general resumption. Certain dockers who refused to handle goods for lorries manned by non-union drivers were returned to the Pool by the employers, and before the end of the day nearly 6,000 men were on unofficial strike in sympathy with the men

Editorial Comments—continued

sent back because they would not do the work required of them.

Union officials got these men back to work, but on November 3rd a fresh strike developed, involving some 7,000 men and holding up work on 75 ships. Marney told men in the Royal group of docks that the men who had refused to load lorries had not been reinstated, whereas the fact was that no action was either taken or intended to be taken against them. Thus, although men in the docks originally affected soon learned the truth, some 3,800 men in the Royal Docks remained on strike, even when the men they were supposed to be supporting were actually in employment.

When the strike was called off later in the day, strikers were already questioning why they were out, when the men they were supporting were in; and some grumbled at losing a day's pay for nothing. Yet it is a fact that few asked why they were on strike and it is very probable that still fewer gave any consideration to the fact that they were acting unconstitutionally.

We therefore return to our original question. Why is the conciliation machinery of the industry not properly used? Only part of the answer, we feel, is given in the conclusions of the Court of Inquiry, which are printed on page 220 of this issue. Pursuing the points made by the Court, we may well ask how it is possible for bodies of men and for individuals, with such disrupting influence, to remain so intimately connected with the industry and to wield so much power. It is asked by ordinary citizens: "What sort of an industry is this port industry, which is organised in such a way that neither employers nor union officials can implement a number of the clauses of the statutory scheme controlling it, for fear that masses of men will stop work if they do?"

It is thought that an important part of the answer to these questions may be found in that portion of the National Dock Labour Scheme concerned with discipline. Many practical people (including many responsible union officials) say, simply, that the disciplinary machinery "just isn't effective," and it is usually well-nigh impossible to bring to task men breaking the conditions of their employment. This state of affairs, they add, is not only affecting the work in the ports by making it almost impossible (for instance) to prevent late starts, early finishes, prolonged refreshment breaks, and also the operation of many restrictive practices, it is enabling the unofficial leader to usurp the position and power of the union official. The unofficial leader makes or inspires irresponsible, exhorbitant and unconstitutional demands—for example, that if the employer calls for overtime to be worked on the first day of working a ship, he must call for the same overtime on each successive day until the ship is finished!!!—and the men who follow him (often withdrawing their labour until they get what they want) know how difficult it is *under present arrangements* for the employer of labour, or a constitutional Union, to take satisfactory action against them.

If this is true (and there is plenty of evidence that it is) it would seem that the disciplinary machinery of the Scheme needs a radical overhaul. If discipline in work cannot be enforced, it is unlikely that there will be constitutional action in disputes.

A final but very important aspect of the whole question is that it is believed that certain amendments to the Scheme could make the port industry in this country a less vulnerable target for disaffected bodies.

Topical Notes

Discussions on Barbados Port Project.

The Colonial Office has announced that discussions were held in London recently on a deep-water harbour project for Bridgetown, the capital and only town of the island of Barbados. The meeting was between representatives of Her Majesty's Government and a Barbados delegation, including the Governor, Brigadier Sir Robert Arundell, the Prime Minister, Mr. Grantley Adams, and the Financial Secretary, Mr. E. S. S. Burrowes.

Although the discussions have cleared up a number of points of difficulty, they have shown that further information is necessary on certain technical questions before the financial aspects of the scheme can be determined. For example, it has been suggested that economies might be made by reducing the proposed number of berths as some of these may not be immediately necessary. It is also thought advisable to examine in greater detail the provision of up-to-date harbour installations. Further expert advice is to be obtained on these questions. Meanwhile, both parties to the discussions are agreed that:—

(a) The deep-water harbour scheme is a useful and desirable development project which should proceed, subject to satisfactory examination of the technical points mentioned above.
(b) The project, once approved, will be given the highest priority in the Barbados development programme.
(c) The project is of the kind that would in principle qualify for assistance from colonial development and welfare funds, subject to the further examination of the technical and financial aspects which will show whether such assistance is necessary.
(d) Barbados will be granted access to external borrowing facilities for purposes of raising a loan to finance the project.

The cost of the present provisional scheme has been variously estimated to be between £4 and £4½ million which, it is suggested, should be raised by a loan on the London market. Although the project has received the support of the authorities in the island, it has also had to face local opposition. At present all ocean-going ships reaching Barbados have to discharge or take on both passengers and cargoes by lighters. Lighterage is expensive, and is estimated to add £1 a ton to both exports and imports. Passenger traffic also can be seriously inconvenienced by the enforced use of lighters in rough weather.

Opponents of the proposal do not deny the existence of the need, but are concerned about the suggested method of financing. They point out that a small island such as Barbados (with a population of only about 225,000) might find difficulty in servicing a loan of this kind. Supporters of the project argue that the construction of the deep-water harbour might lessen the island's dependence upon the export of sugar, by fostering the tourist trade and by encouraging the growth of trans-shipment business.

The proposed harbour would be constructed by reclaiming land up to Pelican Island, on one side of the present careenage, and by dredging the seabed, which consists chiefly of coral. This would allow five ocean-going steamers to come alongside, and the reclaimed area would be used for industry. A further argument in favour of the project is that it would make possible the bulk loading of sugar, as in Trinidad and elsewhere, thus eliminating the use of sacks. This is physically impossible in present circumstances.

Modernisation at the Port of Mobile, U.S.A.

An expansion and modernisation programme, estimated to total $500,000, is now in hand at the Alabama State Docks in the Port of Mobile. The principal feature of the scheme is a shipside storage warehouse designed to meet the need of an increasing volume of imported cargoes. The warehouse, which will be used for storage of such imports as crude rubber, copper ingots, peat moss, canned goods and jute bagging, will cost $350,000 to construct and will be built slightly back from the piers. It will have some 1,100,000 cu. ft. of storage space, and will have rail sidings and truck platforms for loading and unloading freight.

Other improvements to be undertaken include an expenditure of $58,000 for roundhouse expansion and modernisation of the docks terminal railway. Recently, the terminal railway completed a programme which involved putting into service diesel locomotives. The port now has all its facilities served by diesel locomotives equipped with two-way radio communication system. A machine and repair shop for the bulk material handling plant is also part of the project and will cost $31,000. An additional diesel crane for the general handling of cargo is also to be purchased at a cost of $70,000.

Imported merchandise can be held in storage warehouses at the State Docks for a period of 12 months and still retain its identity as an import shipment, thereby enjoying not only the lower import rail freight rate but also the reduction in wharfage and loading charges allowed under rate tariffs applicable from shipside.

The Humber Ports

(4) The Port of Goole

(Specially Contributed)

(Continued from page 166)

THE industrial areas served by the Humber Ports are some fifty miles away in the West Riding and South Yorkshire. This factor of distance has had its effect in a variety of ways, not the least of which has been the development of the Port of Goole, now administered by the British Transport Commission as a constituent of the Humber Ports Group, although actually situated on the lower reaches of the River Ouse. Goole is about fifty miles from Spurn at the mouth of the Humber, thirty miles inland from Hull and eight miles above the confluence of the Rivers Ouse and Trent which form the Humber Estuary.

Trade in the West Riding of Yorkshire, particularly that of the woollen industry, was growing in the seventeenth century and transport, which was almost entirely by road up to that time, was hazardous and slow. Nature provided an alternative in the existence of several rivers and in 1698 an Act was passed "for the making and keeping navigable the Rivers Aire and Calder for the purpose of the advancement of the clothing and other industries." These improvements consisted mainly of deepening the rivers between Leeds, Wakefield and Weeland on the River Aire. River traffic within this area became an established fact and it was not until a hundred years later in the reign of George III that further improvements were made to provide access to the Ouse by the River Aire at Airmyn from Weeland.

It is known that a jetty existed at Airmyn but there are no records of the volume of business which passed; it is easy, however, to envisage the problems of navigation which would be encountered and these gave rise to the next major development, the construction of the Selby Canal, from a point on the River Aire, below Weeland to the then village of Selby on the River Ouse. As a result, water transport between the industrial areas and towns on the Ouse and Humber, and above all an outlet to the sea, facilitated the further expansion of the woollen trades. The growth in the size of shipping, however, and the problems of navigation in the upper reaches of the Ouse convinced the Navigation Authority that some alternative and improved route would have to be found.

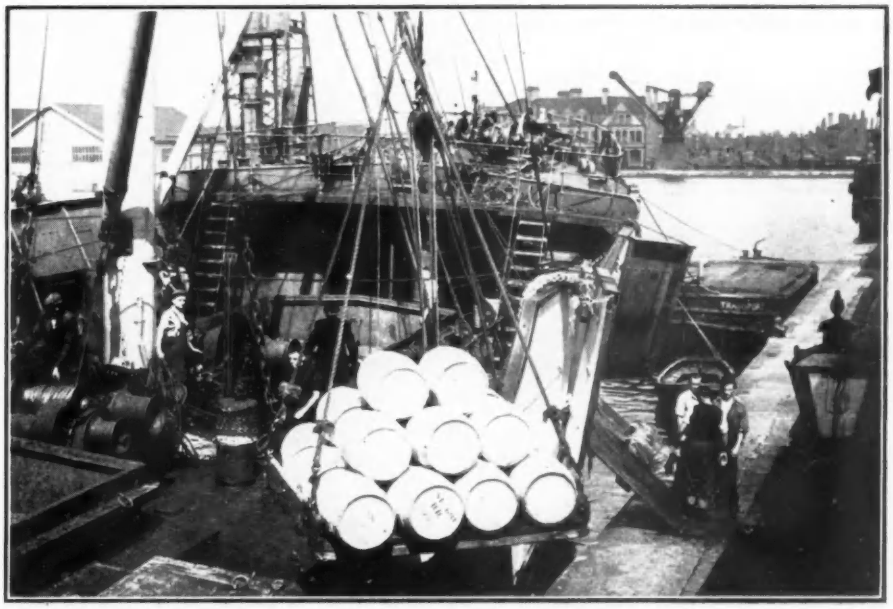
Therefore, in 1820, the Undertakers of the Rivers Aire and Calder were empowered to construct the Knottingley to Goole Canal joining the River Ouse near the outfall of the River Don, and by 1828 Goole had been appointed a port in the United Kingdom, with legal quays for the loading and unloading of goods. The Aire and Calder Navigation were also authorised to construct wet docks and to extend the then existing docks at Goole.

In 1845 the Wakefield, Pontefract and Goole Railway was authorised and in the following year a jetty, station and coal staith were to be constructed in the Railway Dock at Goole. From the middle of the century the port ceased to be solely a point of exchange for goods between ship and craft and offered facilities for connection with the main line railways of the country. Thenceforward Goole was to prosper by reason of geographical advantage in relation to industrial Yorkshire, until by the turn of the century it enjoyed a considerable Continental as well as coastwise trade.

To-day the port comprises eight docks with a water area of 38 acres, 3 miles of quay and 25 miles of railways and the Undertakers, originally the Aire and Calder Navigation but now the British Transport Commission, are responsible for the management of the docks, many of the inland waterways and for the Conservancy of the River Ouse from a point approximately 1¼ miles above the docks to its confluence with the River Trent. The Conservancy powers were acquired from the River Ouse (Lower) Improvement Act, 1884, authorising the construction of training walls and the lighting and buoying of the channel as necessary to improve the navigational facilities of the port. A series of training walls on each bank of the river have been constructed within the area and the navigable channel deepened. A jetty was also built at Blacktoft on the north bank of the River Ouse near to the confluence with the Trent, so that under adverse weather and tidal conditions vessels inward or outward bound can tie up in a safe deep water berth until able to proceed.

The early docks were constructed adjacent to the original canal which entered the River Ouse from the Barge and Ship Locks and now form the southern group. These docks were not railway connected as some were built before the opening of the Wakefield, Pontefract and Goole Railway in 1848 and all were designed to serve the waterway interests. The Ship and Barge Docks, for instance, were opened in 1826 and were the first facilities offered for the transfer of cargo from ship to lighter.

At the west side of the Ship Dock is a group of sheds, to which rail facilities were later given, where terminal services are now provided in connection with the Commission's waterways traffic and where there are storage and transit facilities for wool brought coastwise from London and for general traffic from Continental or coastal ports. On the oposite side of the dock is an island site, known as Bond Island, deriving its name from the bonded warehouse which stood



Port of Goole : Discharging butter and bacon from the Continent.

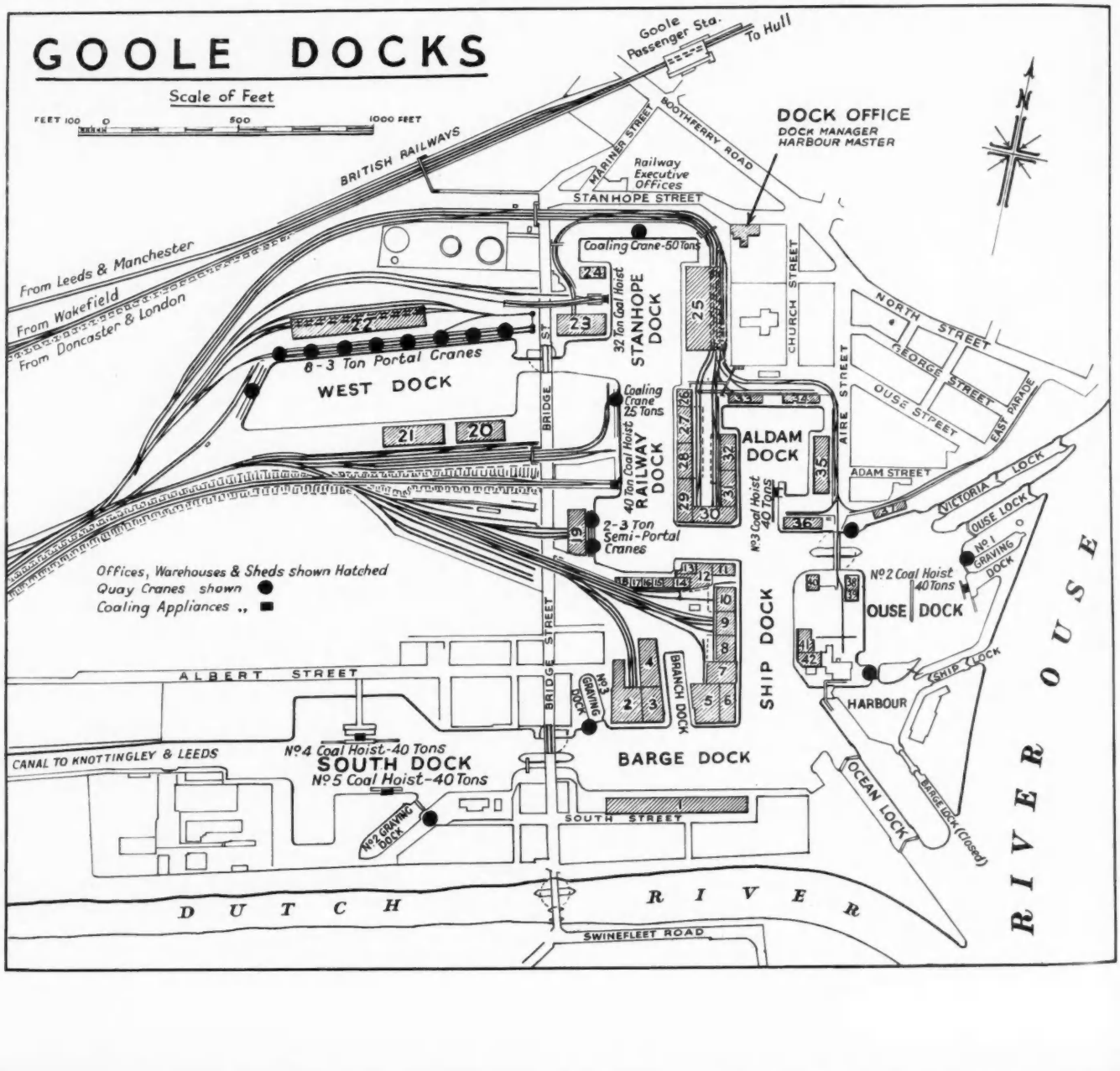
The Humber Ports—continued

there until accidentally destroyed by fire in 1947. Several warehouses however remain and it is hoped eventually to re-design and equip Bond Island on up to date lines.

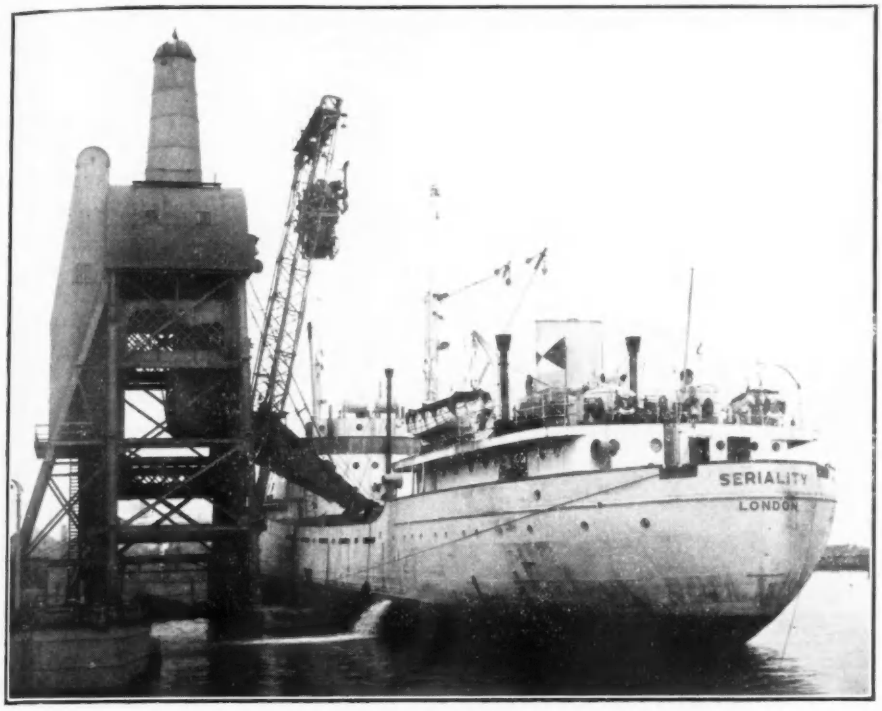
The Barge Dock was at first a small dock near to the Harbour Basin and used by barges from the canal which entered the dock area of that time at this point. It has subsequently been enlarged in stages by including the terminal section of the original canal. On the south side of the dock is a shed, built just before the Second World War for imports from Holland and the Baltic, and which is used by the Lep Transport and Depository Ltd. On the north side of the Barge Dock is No. 3 Graving Dock and a small dock, known as the Branch Dock, where Messrs. Wm. France Fenwick and Co. Ltd. handle appreciable quantities of Australian and New Zealand wool carried coastwise from London. Immediately west of the Barge Dock is the South Dock, opened in 1910. It is equipped for the shipment of waterborne coal and includes the No. 2 Graving Dock. Just beyond this point to the west, the canal enters the docks system.

It is convenient here to refer to the conveyance of coal by waterway for shipment at Goole, as developed by the Aire and Calder Navigation. Their early Acts authorised the construction of staiths for the loading of coal at places near to the collieries along the waterway, and towards the end of the last century a type of steel compartment boat, of 40 tons capacity, was designed, which could be coupled to similar boats to form a " train " for towage by tug to Goole for shipment. This method of conveyance enabled the Navigation to haul with one tug up to 19 compartment boats, carrying in total 760 tons. At the Goole Docks a compartment hoist was specially designed for lifting the compartments bodily out of the water and tipping the contents through a chute. There are to-day four of these shipping appliances at Goole, two having been provided in the South Dock, which was built by taking in sections of the canal, to give sufficient space for the hoists as well as ample room in which to place the loaded or empty compartment boats. The other two compartment hoists are in the Aldam and Ouse Docks.

Coal shipment grew rapidly after the introduction of this system and a peak was reached in 1913 at over one and a half million tons. Prior to the Second World War there were over 1,100 compartment boats in service but this number was reduced during the war years and now stands at 646, sufficient for the present business as not all the collieries providing coal for shipment through Goole are water connected. There is in fact a smaller output from the West Riding collieries for shipment because of the heavy industrial demands of the area, but even so the tonnage of " compartment " coal shipped has steadily improved since the war and the figure of 837,643 tons in 1953 was



The Humber Ports—continued



Shipping coal from compartment boats at Goole.

the highest, except for the year 1937 since about the 1920s.

As the size of shipping grew and the docks were extended the early locks were unable to cope with the traffic. The Ouse Lock, 58-ft. wide and 264-ft. long, was opened in 1838 and the Victoria Lock alongside, 47-ft. wide and 500-ft. long, in 1888. Entry to these Locks is from the north-east, that is facing up-river, and vessels arriving at Goole swing in the river before entering the docks. The Ocean Lock, leading directly into the channel was opened in 1938. It is 80-ft. wide and 275-ft. long and its provision has led to the closure of the Barge Lock; Ship Lock will eventually also be closed. The Ouse and Victoria Locks lead into the Ouse Dock, opened in 1838, where the principal facilities are the No. 2 Compartment Boat Coal Hoist and No. 1 Graving Dock; on the west quay is the Bond Island, mentioned previously, lying between this dock and the Ship Dock.

The Parliamentary powers in 1846 authorising the construction of the coaling appliances also enabled the Navigation and the Railway to develop the Railway Dock, for the Navigation Authority at the time owned all the land in the Parish of Goole. On the east quay of the Railway Dock are four sheds now used primarily for traffic to and from Hamburg and Copenhagen; these sheds were once adjacent to the site of the terminal passenger station of the Lancashire and Yorkshire Railway at Goole. The dock was designed to handle rail traffic and it forms the first of the northerly group which were constructed by the Navigation Authority but into which the railway entered by agreement with them.

North-eastwards the Aldam Dock was opened in 1881. Here is situated the No. 3 Compartment Boat Coal Hoist together with several transit and storage sheds. To the north is the Stanhope Dock, built ten years later, at which there are two rail served coaling appliances, two small transit sheds on the west side and a larger shed, equipped with overhead cranes, on the east side, mainly used by the Antwerp and Amsterdam regular steamers. The Aldam and Stanhope Docks, were to be the last developments east of the main road leading from Goole southwards (Bridge Street), while the opening of the Stanhope Dock necessitated a diversion of the railway which had previously skirted the Railway Dock on its way to the Goole passenger terminal. The principal lines were then sited sufficiently far north to allow of the construction of a new dock west of Bridge Street. This, the West Dock (1912) is the largest of the Goole Docks, with a water area of seven acres and with berths for an average of seven ships.

The north quay of the West Dock was developed in 1932 and is equipped with eight 3-ton portal cranes and a transit shed with overhead travelling cranes. At the west end of the dock is a 40-ton electric travelling coaling crane which is employed also for general heavy lifts as are other high capacity cranes about the docks. On the south side are two transit sheds used for rail, road and canal traffics. Most of the vessels trading with Goole are coasters or colliers, requiring a quick turn-round, and the facilities here have made it the principal terminal point for bulk cargoes destined inland and similarly in the reverse direction for export.

The Aire and Calder Navigation reserved a portion of ground south of the West Dock, where they proposed to build another dock, which would have been called the Central Dock, with access direct from the canal. The prospects in 1912 when the West Dock was opened, warranted the Navigation Authority making this provision but it may be that with the possibility of developments elsewhere within the docks, together with altered trading conditions to-day, the Central Dock scheme might not materialise and the site might perhaps ultimately need to be developed on different lines.

During the last few years improved road dealt mainly with cargoes of coal, lime, grain, timber and raw wool, but from the closing years of the nineteenth century up to 1914 there was a substantial increase in

General view of West Dock Goole from the south west corner.

The Humber Ports—continued

Shipping in West Dock Goole, looking from the east.

general cargoes, more particularly in the home trades. Then followed the difficult period of two world wars with the intervening years but in 1953 over three million tons of traffic were dealt with, of which 2.6 million tons were coal, shipped through the five rail-borne and four compartment boat appliances.

During the last few years improved road access has been given, particularly at certain berths previously only rail connected, and the works at present in hand or contemplated include the reconstruction of the Ouse and Victoria Locks, the replacement of the coaling crane at the Railway Dock by a new appliance, the erection of a new reinforced concrete jetty at Blacktoft in place of the existing timber structure and the acquisition of a new dredger. Detail of these items will be given in a later article.

Goole is a town which has grown from a very small beginning to a thriving community of over 20,000 inhabitants following the provision and development of the docks. In its early years the Aire and Calder Navigation provided the houses for its staff of all grades and were responsible for many of the public services, including gas. They admitted the railways to the docks on the basis of leasing their property for the erection of sheds, hoists and cranes for railway terminal purposes. Some of these powers, through changed conditions over the years, have either lapsed or have been vested in the British Transport Commission.

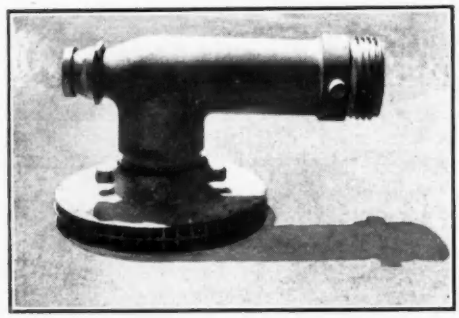
The docks at Goole constitute a compact and efficient port. With the facilities which it has to offer and with its proximity to industrialised areas it plays an important role as one of the Humber Ports Group.

Ejector Pump for use on Ship Fires

Method of Assisting Ship Stability

by E. T. HAYWARD, O.B.E., M.I.FireE.
Chief Officer, Southampton Fire Department.

The main shipping risk in the Port of Southampton is that of passenger ships and experience has shown that during fire fighting operations on such vessels, water accumulates in cabins and conpartments where it is trapped, with no means of draining away. For example, during a fire in cabin accommodation of a large liner, water from two sprinkler heads and one fire fighting jet flooded two cabins and adjoining bathrooms to a depth of 18-in., and the only method of disposal was by baling and discharge down toilets. In serious fires the water problem would be magnified many times on several decks, thereby quickly affecting the ship's stability.



Photograph of the pump with the low-level suction strainer fitted for use in confined spaces, such as working alleyways, etc.

It is interesting to note that fifteen tons of water on an upper deck of a cross-channel steamer of approximately 3,500 tons is sufficient to start a list.

A $\frac{3}{4}$-in. nozzle at 50 lb. nozzle pressure discharges approximately 100 gallons per minute which represents about 26 tons of water per hour. Working on these figures, it means that the Fire Service has about half-an-hour with one $\frac{3}{4}$-in. jet in which to control a serious fire high up in such a vessel, and this makes no allowance for water discharged from sprinkler heads.

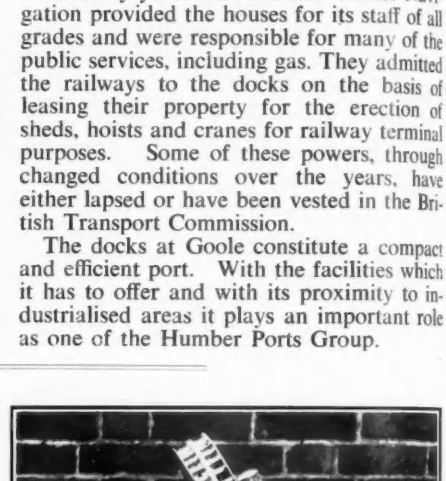
In attempting to deal with this problem normal pumping equipment was considered and the following conclusions arrived at:—

(a) Trailer pumps are inconvenient to handle and position on board during an emergency.

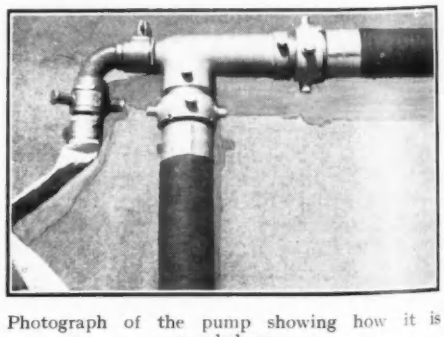
(b) Trailer pumps are unsuitable for use in a confined space owing to ventilation difficulties—this is especially true in a working alleyway.

(c) Electrical submersible pumps are heavy and inconvenient to handle. In addition, if the ship is "dead" it is necessary for a power supply to be taken on board.

(d) Electrical submersible pumps and hydraulic deep lift pumps are not readily available in numbers during a really serious fire.



View of the low-level strainer which will permit the pump to drain water to a depth of about 2-in.



Photograph of the pump showing how it is coupled up.

Ejector Pump for use on Ship Fires—continued

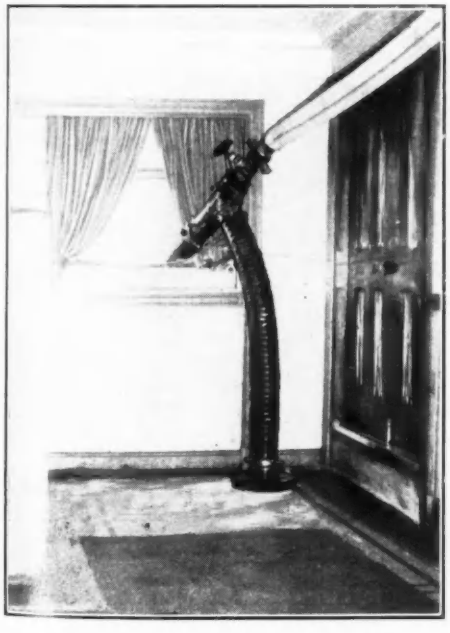
With this problem in mind, the Southampton Fire Department endeavoured to find a quick and easy method of removing the water from the numerous compartments and cabins and discharging it outboard. The object was to produce a unit that would give a substantial discharge with average lifts, was easy to manufacture in quantity, light in weight and required no special equipment or power supply for operation. It was considered that the ejector pump as designed would meet these requirements.

Following extensive tests of prototype pumps of various sizes, which were constructed locally, it was decided that 4-in. units having standard 4-in. round thread couplings were the most suitable as they are easily handled, the output is satisfactory using priming nozzles of economical sizes, and the majority of fire pumps, particularly reinforcement units from the County area carry 4-in. suction.

The advantages of the ejector pumps are that where men can get with a line or hose a pump can be put into position and, providing the priming nozzle is kept charged, it will require no further attention. Even if the men are driven back by smoke and heat the pump, being self-priming, will continue to function all the time there is water to be removed.

Whilst we do not claim to have found the complete answer to the question of free water in fire fighting operations, it is felt that there is now a reasonable chance of preventing a serious stability problem developing and, to say the least, equipment is now available in the Southampton Fire Brigade which will be of great value in this respect, whereas before there was no satisfactory solution.

It will be appreciated that in dealing with this problem of free water and ship stability during fire fighting operations, it is of little use to tackle the situation once large quantities of water have accumulated and the vessel has taken a dangerous list. It is, therefore, now our policy for fire fighting and removal of water to be carried out simultaneously. As soon as the Brigade arrives at a fire where jets are required, one senior officer will be responsible for fire fighting and another for the removal of accumulated water, such operations being conducted in consultation with the Dock Master and Ship's Officers. Even in the most serious of ship fires there are accumulations of water which are accessible to a pump, and every gallon discharged overboard assists in the fight for maintaining stability.



View of the pump working from cabin accommodation.

It will be noted from the above that our efforts to date have been concerned mainly with the removal of water from upper decks, but the difficulties that can arise in cargo vessels where large quantities of free water may collect have not been overlooked.

These pumps are not suitable for pumping against head but are efficient when lifting water and discharging it with the delivery hose outlet within a reasonable level of the pump. The most efficient method is to arrange, if possible, for the delivery outlet to be at the level of, or lower than, the water to be removed in order to take advantage of the siphon action once the pump is primed. Over average lifts a ¾-in. nozzle is the most economical size to use and with a lift of 8-ft. the output of these pumps is approximately 300 gallons per minute, which is equivalent to 80 tons per hour. Lifts up to 30-ft. have been obtained quite easily with a 1-in. nozzle but at this height the output is naturally reduced. It should be mentioned that in the average liner the height of the port-hole from the deck rarely exceeds 7-ft. and, even if the pump has to be operated from the deck above, this height rarely exceeds 16-ft. It is felt, therefore, that in a fire in passenger accommodation there is a reasonable chance of getting at some of the trapped water and discharging it outboard.

The table below shows results of actual tests at various heights and in each case the output excludes the water discharged from the priming nozzle.

¾-in. Nozzle—100 lb. Pressure.

Suction Length	Mean Lift	Discharge Hose	Discharge galls. per min.
8-ft.	6-ft. 6-in.	15-ft. x 4-in.	307
16-ft.	14-ft. 6-in.	15-ft. x 4-in.	272.5
24-ft.	22-ft. 6-in.	30-ft. x 4-in.	252

1-in. Nozzle—100 lb. Pressure.

Suction Length	Mean Lift	Discharge Hose	Discharge galls. per min.
8-ft.	6-ft. 6-in.	15-ft. x 4-in.	350
16-ft.	14-ft. 6-in.	15-ft. x 4-in.	285
24-ft.	22-ft. 6-in.	30-ft. x 4-in.	272.5
30-ft.	30-ft. 6-in.	30-ft. x 4-in.	140

These tests were made by using a steel tank of 280 gallons capacity and the provision of a separate water supply for the priming jet, the time taken to empty the tank being measured by a stop-watch. Higher outputs have been obtained at the same lifts but this was due to variations in the barometric pressure when the tests were made.

This photograph shows the pump working outside of a ship, i.e. the suction is laid through a port and the delivery line feeding the priming nozzle is outside the vessel. A pump would only be used under these conditions if it were impossible to gain entry into the ship.

In addition to their use on ships, these pumps have been used on many occasions for pumping out and special service work. In one case three ejector pumps fed by one large trailer pump were used on special service work at the King George V Graving Dock, Southampton, and it was estimated that the discharge of the Trailer Pump and the three ejector pumps was in the region of 1,200 gallons per minute.

For the purpose of the demonstration on the "Winchester Castle" on the 6th October, 1954, a 280 gallons tank was placed on the lower 'tween deck of the after hold where it was assumed that flooding had taken place during the course of fire fighting operations. The ejector pump was positioned two decks above to enable the delivery hose to be taken outside through a shell door. The ejector pump was fitted with a 1-in. priming nozzle and supplied from a pump ashore at a pressure of approximately 90 lb. per square inch. The discharge from the tank was calculated by the means of a stop-watch and the results given in gallons per minute and tons per hour. The test was entirely satisfactory and indicated that water could be removed from the lower 'tween deck at the rate of 300 gallons per minute or 80 tons per hour.

Dredging of Maracaibo Channel.

A contract for dredging the new Maracaibo Channel has been signed between the Government of Venezuela and a U.S.A. firm. Studies are also being made for the construction of a bridge across Lake Maracaibo, which would be threequarters of a mile long.

Palletisation and Shipping — 1954

(3) The "Large" or "Maritime" Pallet

By E. S. TOOTH

The task of formulating international standards for pallets for the unit load method of materials handling is being undertaken by Technical Committee 51 of the International Organisation for Standardisation. Although the full committee has so far only met twice (in December, 1952, and June, 1954, each time in London), considerable progress has been made and three sizes of "normal" pallets have been recommended for standardising.

From the beginning of their deliberations, however, the Committee have met difficulty when considering the question of standardising a large pallet, particularly for sea transport. At the 1952 meeting it was decided to postpone consideration of this matter until further experience had been gained; at the 1954 meeting, as stated in the second article on this subject (which appeared in this Journal last July) discussion proved that the question of this "large" or "maritime" or "stevedore" pallet was so involved and controversial that it was decided to refer it to a specially constituted Working Group.

This Working Group met in Amsterdam in October, 1954, at the invitation of the Netherlands Standards Association in conjunction with the Royal Netherlands Steamship Co. It consisted of representatives, especially those of shipping interests, of the Belgian, French, German, Netherlands, Norwegian, Swedish, Swiss and United Kingdom delegations to ISO/TC 51. The British Standards Institution provided the secretariat.

Since Holland is one of those countries using large quantities of big pallets (up to a length of 6-ft.), their representatives were able to arrange a number of useful demonstrations at certain berths in Amsterdam. These included:—

(1) the loading of goods from river craft into ship's hold by means of big pallets (48-in. x 72-in.), lifted by crane;

(2) the handling of goods on this type pallet into and out of railway wagons with doors (a) 1.8 metres wide and (b) 2 metres wide;

(3) the handling of palletised unit loads by using big pallets as master pallets—i.e. by placing two small load pallets on one big empty pallet and then lifting, and

(4) loading a Rhine barge with goods on pallets, using a special "pallet-hook.' This tool is the equivalent of the forks of a fork truck and is so constructed that when suspended from crane or ship's purchase, the forks hang parallel with the ground. Manual power is used to engage the forks in the pallet.

The Working Group also visited a modern ship with flush decks, fit for the use of fork-lift trucks in 'tween decks and lower holds. It also saw, at the instigation of the Norwegian delegation, palletised bales of paper being unloaded from ship's hold, where they had been stowed three pallet-loads high, on to the quay where they were transported into transit shed by fork-lift truck. Pallets of dimensions of 48-in. x 64-in. and 40-in. x 80-in. were being used for this operation. There were also other large pallets in use at this berth, one size (an extreme) being approximately 60-in. x 120-in. The Working Group was here informed that although so far only about 25 per cent. of the cargo carried had been palletised (at the loading port), there had been an increase in the speed of discharge of over 30 per cent. Most of the palletised cargo is at present stowed in the biggest holds. This vessel, by the way, was a general cargo vessel with a reasonably deep lower hold. Certain ships in the short sea trade are now being built with 'tween decks only high enough to accommodate one tier of loaded pallets.

The various demonstrations and visits were interesting and instructive and the use of the "pallet-hook" emphasised that it must be borne in mind that more new types of equipment for handling palletised loads may yet be invented.

The first decision made by the Working Group was to confirm that, despite all the difficulties due to the requirements of different types, sizes and designs of existing ships, vehicles and premises, there is need for a large standard pallet to travel across the seas for throughout movement. This arises from the need to give the dock quay cranes (which nowadays have a lifting capacity of at least 3-tons) and ships' purchases an economic load. Large pallets are already in use in many ports of the world but frequently only as dock tools, in which case they do not come within the scope of the technical committee's work.

Requirements of Maritime Pallets.

It will be interesting at this stage to consider the factors which influence the determining of a plan size for a large (seagoing) pallet. From the shipping angle it must be as large as possible, without being cumbersome or too heavy. From the land angle, it must not be so large as to create important handling difficulties in factories or to road and railway contractors. Taking a long view, it is probable that factories and shippers' premises concerned with palletised exports will ultimately be suitably designed or adapted, but there may not be so much opportunity to adapt road and particularly rail vehicles. Packaging, too, is important in this matter, for it is obvious that where packaging interests have followed the sizes of the "normal" pallets already recommended for international standards (viz. 32-in. x 40-in., 32-in. x 48-in. and 40-in. x 48-in.), there must be some relationship between the dimensions of normal pallets and those of the big pallet under consideration.

These and other aspects of the question were discussed in meticulous detail by the Working Group, which also reviewed all the evidence which had been gleaned of developments in other countries, including the U.S.A. The point whether the big pallet was for use (a) only between port and port, or (b) if necessary, between shipper and receiver, was also raised and the decision made that it must be considered for throughout movement.

The conference was then ready to discuss plan sizes. The width was agreed at 48-in. in tune with the larger dimension of the 32-in. x 48-in. and 40-in. x 48-in. pallets already recommended for standardising. Discussions on length revolved mainly around 64-in., 72-in. and 80-in. In favour of the 64-in. length is the fact that it is a multiple of the width of two of the normal pallets (32-in. x 40-in. and 32-in. x 48-in.) and also that it is in general use in several European countries. The 72-in. pallet, being bigger, would be preferred by shipping interests and is already in use between France and the U.S.A. and France and North Africa. It may be a slight disadvantage (from the packaging point of view) that it is not a multiple of any small pallet dimension. A pallet 48-in. x 80-in. would probably suit shipping companies purely from the point of view of size but might be too cumbersome and heavy for quick manipulation. Difficulties in loading large pallets into railway wagon can be minimised. Experiments in loading through wagon roofs have already been made with mainly satisfactory results.

The Working Group finally recommended "that pallets of nominal plan size 48-in. x 64-in. (1200 mm. x 1600 mm.) and 48-in. x 72-in. (1200 mm. x 1800 mm.) should be included in an ISO recommendation relating to large pallets."

Before dispersing, the Group considered two other matters of importance, namely:—

(1) the securing of the load on the pallet and the limitation of the load; and

(2) the desirability of standardising handling equipment other than fork-lift trucks and pallet trucks.

There is no doubt that the international aspect of pallet standardisation is of utmost importance. Work on it is of necessity slower than work on national standards—the ideal would be for the two to be undertaken simultaneously—and in some cases, the fact that national pallet standards had either already been set by practice or actually agreed by national bodies, has made the work of the ISO more difficult. Yet a pattern is evolving and there is no doubt that in the course of time the benefits in international trade which will derive from this work will be considerable.

Improvements to Ceylon Fishing Port.

The Ceylon Government have undertaken a modernisation project in the fishing port of Mutwal, which when completed will provide a base for the fisheries department's trawler fleet. The scheme, which is estimated to cost 5,500,000 rupees, includes the construction of a quay to accommodate three trawlers, provision of refrigeration plant and a by-products factory. Work on the project began on May 26 last.

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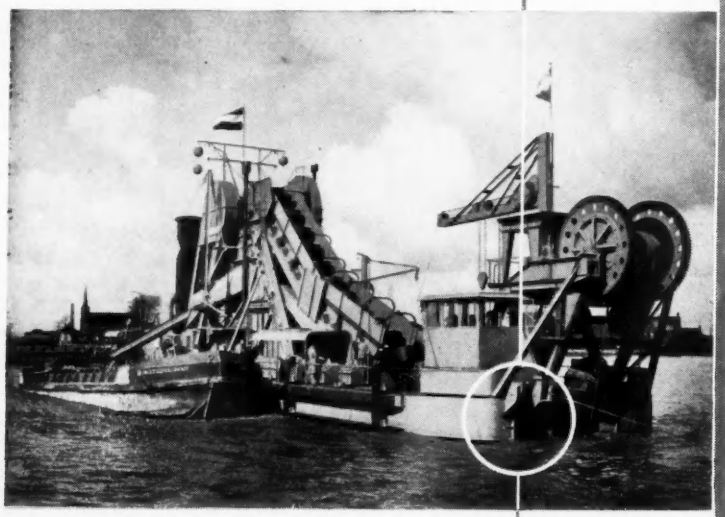

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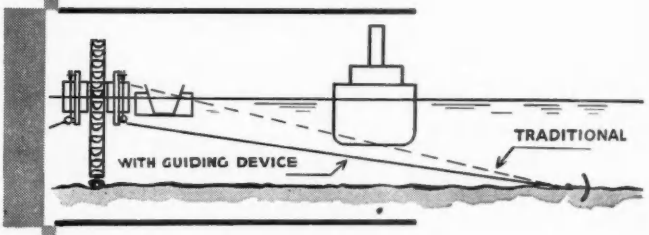

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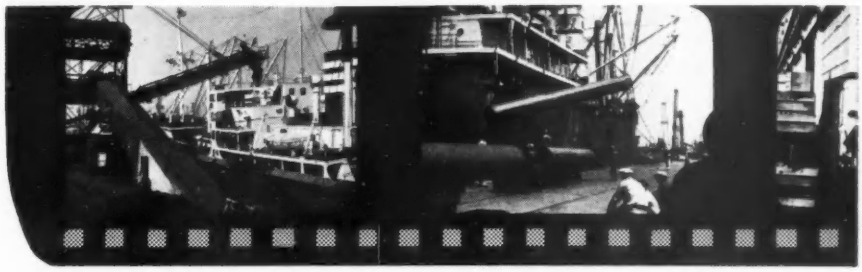

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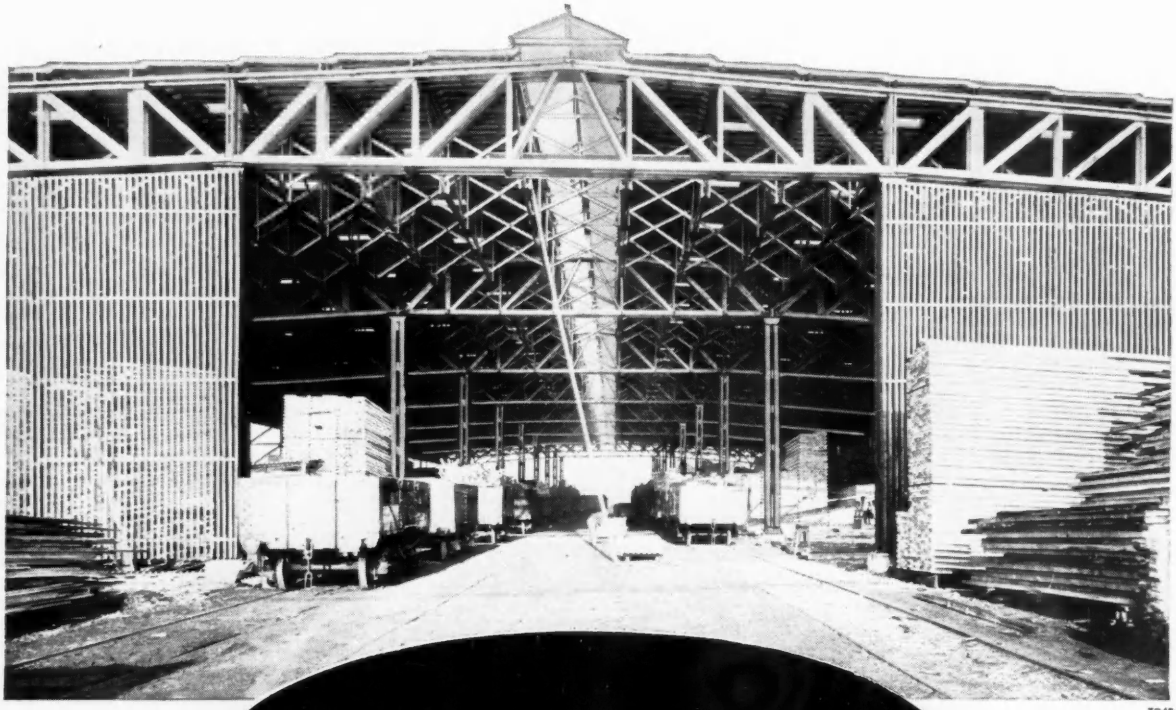

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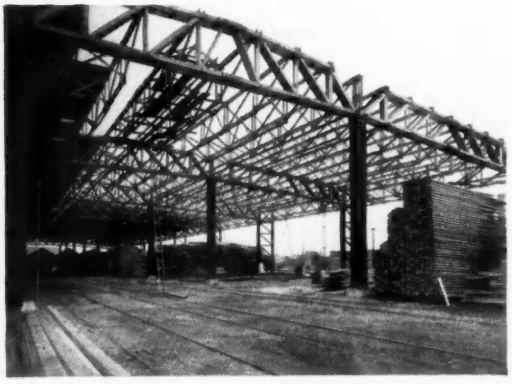

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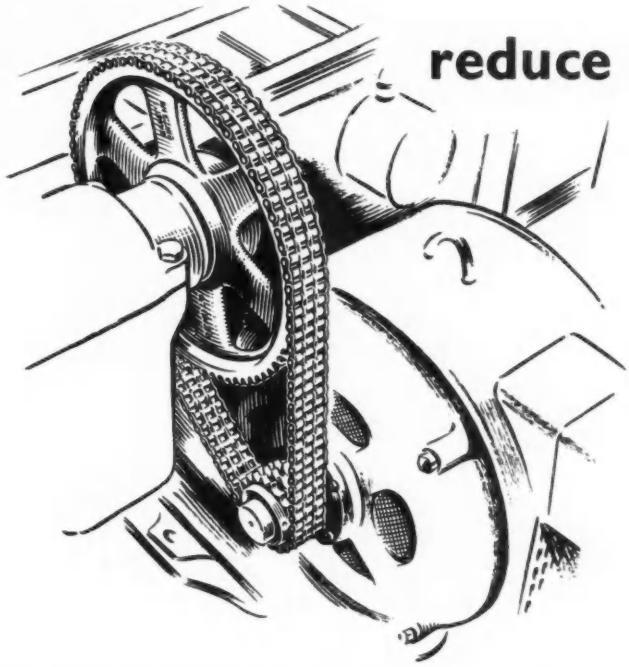

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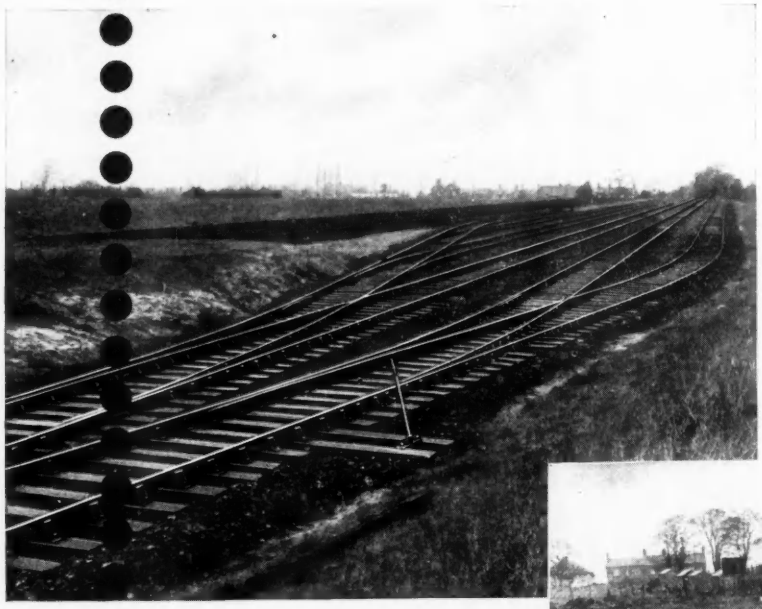

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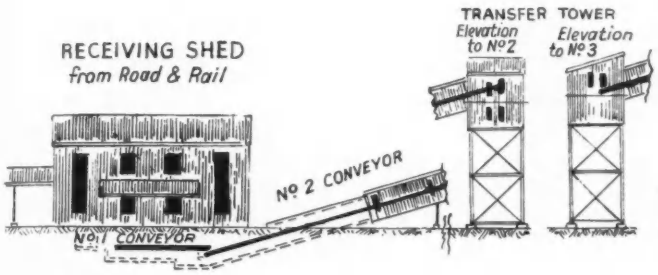
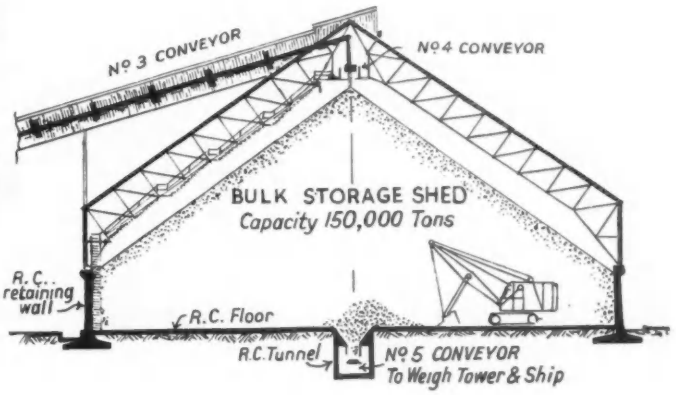
Bulk Sugar Loading in Australia

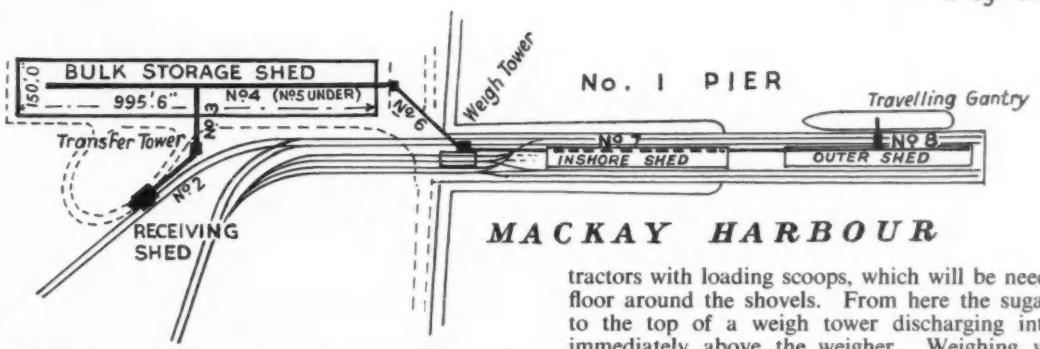
Installation at Mackay, Queensland

The Mackay Harbour Board have recently approved plans for the installation of accommodation and equipment for loading ships with bulk sugar. It is hoped that the work will be completed in time for the commencement of the 1957 crushing season.

A tender for the first contract in connection with the work has been accepted for the construction of concrete foundations for the bulk storage shed. The site chosen is immediately inshore from No. 1 Pier and is lengthwise to the pier. Test bores indicated that there was a considerable depth of sand interspersed at lower levels with beds of clay and sandy clay, and that the foundations would







be quite satisfactory for spread footings without piling. Little trouble was to be expected from seepage. The new shed will be 995-ft. long by 105-ft. wide and will have a capacity of 150,000 tons, which is approximately half the present annual tonnage handled at the port. The shed will be constructed as airtight as possible and condensation will be reduced to a minimum by the use of special corrugated steel sheeting for the roof, upper walls and end walls. This sheeting has high structural and insulating properties, being heavily coated on both sides with bituminous impregnated fibre, and painted on both sides with aluminium paint. Ventilation will be controlled by fans in the two end walls of the building. There should be less loss in deterioration of sugar stored in bulk, as under these conditions it forms a hard 3-in. crust on the outside layer and excludes damp air. In the 1953 season it was estimated that 2,000 tons were lost from sugar stacked in bags, as moist air circulated through the stack and turned part of the sugar into syrup, which ran through the sacking.

Further contracts are to be let for the provision of the conveyor gear, hoppers, weighing machines, etc., to complete the installation.

On its arrival at Mackay the bulk sugar will be discharged from road or rail trucks into a hopper in a receiving shed situate between the road and the rail sidings. The intake capacity will be at a maximum rate of 250 tons per hour, or sufficient to handle, in 10 hours, the combined daily production of all the mills delivering to this terminal. Provision has been made for a combined automatic hopper and weighbridge on the rail siding, and a road weighbridge and automatic overhead electric hoists for discharging the tilting boxes on road vehicles. A sampling elevator will be located at the receiving hopper so that a sample may be taken from each load of sugar as it is delivered. The receiving shed will be constructed of a steel frame with wood purlins and girts, and have asbestos cement walls and roof. A sample room, office, and staff amenities will be located in a brick annexe on the northern side of the shed.

From the receiving shed the bulk sugar is taken by underground conveyor through a tunnel to conveyors into the storage shed. Here it is distributed by a shuttle conveyor in the apex of the roof to all parts of the shed. For loading a ship, the sugar will gravitate through a row of hoppers along the centre of the shed floor on to a belt conveyor located in a tunnel under the floor. Two electric power shovels on the floor of the shed will maintain the flow of sugar on to the hoppers. These shovels will be assisted by motor tractors with loading scoops, which will be needed to clean up the floor around the shovels. From here the sugar will be conveyed to the top of a weigh tower discharging into a batch hopper immediately above the weigher. Weighing will be carried out automatically in 15-ton batches, the weighing cycle being capable of maintaining a uniform flow of 600 tons of sugar per hour.

From the weigher the sugar gravitates to a hopper, from which it will be fed to another conveyor, which in turn delivers it to a conveyor in the shipping gallery. All the shipping conveyors will be carried in enclosed galleries, with adequate walkways on either side. A luffing boom, on which will be continued a cross conveyor for loading into the ship, will carry at its end a vertical telescopic tube. At the foot of this tube will be attached an electrically operated trimmer, which will distribute the sugar to all parts of the ship's hold. The luffing boom, tube and trimmer will be so constructed that they can be easily and rapidly retracted from the hold, and the travelling gantry will be movable from hatch to hatch with a minimum of delay. The whole of the conveyor system and loading equipment in the installations will be electrically interlocked and controlled so that banking up or spillage of sugar will not occur during stoppages.

When the bulk loading installation is complete and in use, the sugar industry expects to make large savings in handling costs. Representatives of the industry have estimated that the annual saving in sugar sacks alone will amount to £250,000. There will also be the saving in deterioration of bagged sugar and from spillage from broken bags. But the greatest saving to be effected will be in the man hours required to load a ship, which should lead to cheaper shipping freights resulting from a quicker turn-round.

Mackay lies 2,000 miles north of the Tropic of Capricorn and is the centre of Queensland's largest cane sugar growing area. The 1,800 sugar cane farms in the district should produce 2,682,000 tons of cane during the 1954 season, and the output of Mackay's seven mills is estimated at 383,000 tons of sugar.

Deepwater and Lighter Quays in the Middle East

Design and Construction in Steel Sheet Piling*

By G. W. NELSON, A.M.N.Z.I.E.,
Senior Engineer, Hydro Electric Design Office, Ministry of Works,
Wellington, New Zealand.

(Concluded from page 187)

Cofferdam at Kad-el-Marakeb (Fig. 5)

At approximately the centre of the 2,000-ft. quay length, the piling pulled up quickly after passing through about 10-ft. of sand and sandy bluish clay. Investigated, it was found that a ridge of rock almost normal to the quay face ran out towards the canal, gradually descending until it dropped below dredging level at approximately 150-ft. from the quay. At the quay face it was a " hump " having a base length of approximately 90-ft. at dredging level, rising to a height of 14-ft. above.

The rock-breaking ship, a broad flat-bottomed craft fitted with two 17-ton needles, each about 45-ft. in length, set amidships and operated by powerful steam winches, was unable to operate closer than 14-ft. from the quay face. The problem was to clear the obstruction and establish the continuous quay face for full dredge depth. The use of explosives at the time was purposely avoided, for it was known that there were many and various types of mines and bombs in the harbour full of ships, and that possibility of serious damage from concussion could not be overlooked. One ship had been already sunk and was resting on the bottom owing to a temporary stoppage of the degaussing system. Several schemes were considered, but it was finally decided to construct a cofferdam over the obstruction, 120-ft. long by 36-ft. wide, and carry out the following:

(a) Excavate an open cut 20-ft. wide to dredge level in the rock.

(b) Excavate trench 6-ft. below dredge level and concrete ends of quay piling in it for toe pressure security.

The cofferdam was waled and braced with available timbers—14-in. x 14-in. and 12-in. x 12-in. oregon—and cross strutted at 11-ft. intervals. Timber piles were driven beside the selected places where bolted support was required for wales and cross strutting (approximately 11-ft. centres each way). As the quantity of timber for wales, braces and struts for the depth of piling that required support was rather considerable, it was not practicable to float the timber in the area and pick it out and frame it in place as the water was pumped out and excavation proceeded. To enable timber to be manoeuvred into place beneath that already framed, a carefully strutted opening about 22-ft. x 11-ft. was formed as illustrated in the photograph. (See Fig. 5).

When the sea-bed muds and clays were removed, great quantities of water entered the area through incomplete sealing of the cofferdam on the irregular rock surface as well as through many faults in the rock itself. The inrush was more than the available pumping machinery could handle.

The cofferdam was allowed to fill and 4-in. diameter holes were drilled into the rock at about 10-ft. intervals and pressure grouted; also a " blister " of sheet piling was driven for about 80-ft. long, 10-ft. out from the outer cofferdam wall, and filled with sea muds, sandy clay and sand. The area inside the blister was also grouted at about 10-ft. intervals

Owing to the open fissures in the rock, the process had to be repeated several times before it was possible to trench the "hump" for a width of approximately 5-ft. to a depth of 6-ft. below dredging level.

Further attempts to widen the trench to the 20-ft. as hoped were frustrated by inrushes of large quantities of water, which beat the capacity of the only pumping units available. Several attempts to grout and pump were brought to nought by further floodings as soon as a few yards of rock were removed. However, the end was achieved—namely, the successful embedding of the main quay wall piles in a safely concreted trench in the rock.

The programme of work was then changed to the following sequence of operations:

(a) Whilst the top of the rock was bared in the cofferdam area, 4-in. diameter holes at about 5-ft. intervals were drilled into the " hump," to 2-ft. below dredging level for 20-ft., from the quay face. These holes were fitted with pipes and plugged.

(b) The cofferdam was then to be removed.

(c) The rock-breaking ship was to break a channel through the rock, and the dredge was then to remove the spoil.

(d) The holes drilled as described in (a) above were then to be washed out and filled with explosives, then blasted in rows, starting with the outer row first. By this time there was less shipping about.

Operation (a) was easy and quickly completed, but operation (b) was a very different story.

Withdrawal of Piles in Cofferdam

It was known in advance that this would not be an easy task. The piles—side-interlocking Larssen—had been driven on to irregular and sloping rock surfaces. It was expected that the bottoms would be somewhat distorted and the grips bent and twisted. The No. 5 piles driven at the ends of " hump " and extracted before the cofferdam was constructed were " corkscrew " or propeller blade shape, over a length of from a few feet to twenty feet.

The first pile chosen for extraction was at the apex of the " hump." A Zenith No. 120 extractor suspended from a 60-ton floating crane was tried, then an inverted No. 7 McKiernan-Terry hammer, followed by a 9 B2 and 10 B3—all without success. A " Pajot " hammer with extracting gear was then tried suspended from the 60-ton floating crane, and operated under 100 lb. steam. It was only with this assembly, aided by the use of two 50-ton hydraulic locomotive jacks operating in " toe holds " gas-cut into the gripping edges each side of the pile, that it was possible to get this pile out.

Over many days, and with much perseverance assisted by jetting, only a few extra single piles were extracted. All piles driven into sandy bed were not over-difficult to remove with the French hammer and extracting gear, or assisted by jetting.

The problem still remaining was to remove the " blister " and the outer wall. Gas cutting under water at sea-bed level was suggested several times, but this would leave a continuous wall of steel sheet piling that would foul the dredge buckets and make matters worse. The piles had to be removed.

Levering out was then tried, with success. The extractor plates of the French hammer were used as saddle cheeks, fitted to and over a lever, 12-ft. long, made up of 12-in. x 6-in. R.S. joists, welded together and stiffened in the webs. This lever was arranged to work on a 3 to 1 ratio. Round pins up to 5-in. diameter were used through the $\frac{7}{8}$-in. thick pile webs, but the bearing intensities in numerous cases were so great that the webs failed. The bearing was then augmented by compensating plates of $\frac{7}{8}$-in. thick steel pile webs welded to each side of the lifting hole, and shape of the hole changed to a rectangle to take 6 bars of $\frac{1}{4}$-in. steel each 12-in. long by 4-in. deep. Similar holes were cut in the saddle cheeks to take the 6 bars.

The reaction at the back end of the lever was taken on a strong platform of welded steel plates secured to the tops of the adjacent piling. The lifting end of the lever was secured to the hook of the 60-ton floating crane and the load taken. This was successful.

Several times the crane was taxed to capacity, and it was estimated that as much as 75 tons was exerted by it on a 3-to-1 ratio to obtain an effective pull of 225 tons on the pile. By a succession of lifts and packing under the reaction end, the piles came out.

* Based on article which appeared in the August, 1933, issue of " New Zealand Engineering," the Journal of the New Zealand Institution of Engineers.

Deepwater and Lighter Quays—continued

The Choice of Steel Sheet Piling for Cofferdams

The struggle to get the piles out of the Kad-el-Marakeb cofferdam illustrates that a side-interlocking pile may not always be satisfactory for cofferdam work in ground where there are obstacles such as large boulders or rock floaters, or where the piles are required to be driven down to a rock surface and later to be extracted.

Nearly all sheet pilings on the market to-day have side-gripping grooves for interlocking the piles. It is in the grip that the extracting trouble lies, for when the piles are driven to contact rock surfaces or boulders, the grips at the ends of the piling become bent transversely, and the pile ends knot up, making it extremely difficult to draw out the piles. The costly and difficult process of extraction has in hundreds of cases forced engineers to resort to gas cutting under water in order to remove walls of sheet piling.

Gas cutting could not be done at Kad-el-Marakeb, because it would leave a sheet of steel in the sea mud over the rock that would foul dredging; they had to come out.

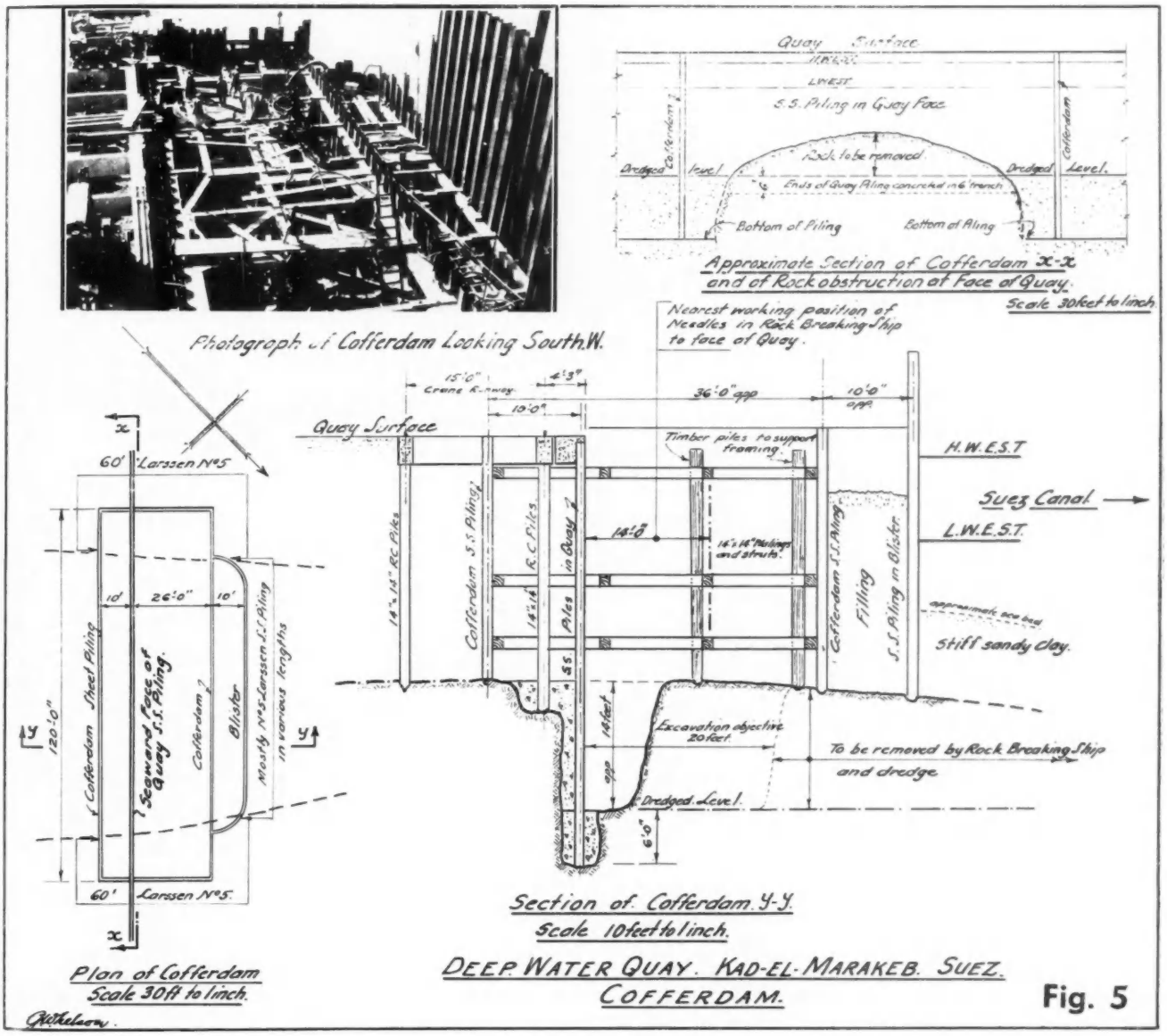
Sound engineering practice requires an engineer to recognise difficulties and apply engineering ingenuity to overcome them. Engineers have long been faced with the difficulties above related, and, whilst these are accepted, not one has yet come forward with a design of a sheet pile that has the driving capacity and strength of familiar proprietary lines and yet has the additional advantage of ease of extraction. Such a pile should have a side interlocking device or clutch that can be readily manipulated or withdrawn to free adjacent piles for individual extraction.

The only sheet pile that had possibilities in the clutching device was the old " Universal," in which a 5-in. " dumb-bell "-like clutch embraced the 5-in. flanges of adjacent rolled steel joists. The flanges and clutch stood up to hard driving, but the pile itself was weak along the web axis and required a lot of support. Yet the clutch provides the genesis of an idea.

One approach to the problem would be a combination of the shape of the Larssen sheet pile fitted with 3-in. flanges and joined by a modified universal clutch reduced from 5-in. to 3-in.

Fig. 6 illustrates another approach. This section shows an interlocking rod, $1\frac{1}{4}$-in. in diameter, joining the two piles. It has all the advantages of other familiar piles with the additional advantage of being extractable after the ends have been distorted through contact with rock surfaces.

The drawing details the driving and extracting procedure. The interlocking rod is a very common size of steel reinforcement for


Photograph of Cofferdam Looking South W.
Approximate Section of Cofferdam X-X and of Rock obstruction at Face of Quay.
Scale 30 feet to inch.
Nearest working position of Needles in Rock Breaking Ship to face of Quay.
Quay Surface
Timber piles to support framing.
H.W.E.S.T
L.W.E.S.T
Suez Canal
Cofferdam S.S. Piling
R.C. Piles in Quay
Filling
S.S. Piling in Blister
approximate sea bed
Stiff sandy Clay.
Excavation objective 20 feet
To be removed by Rock Breaking Ship and dredge
Dredged Level
Section of Cofferdam Y-Y
Scale 10 feet to inch.
Plan of Cofferdam
Scale 30ft to inch.
DEEP WATER QUAY. KAD-EL-MARAKEB. SUEZ.
COFFERDAM.
Fig. 5

Deepwater and Lighter Quays—continued

concrete and is readily obtainable. This is very important, as any joint that requires a specially rolled section to interlock the piles renders one section useless without the other.

The 1¼-in. diameter rod can be extracted as a loose pin in a butt hinge, thus leaving each pile free for extracting singly. Any distorted ends on the piling are able to force the ground in coming out and are not required to force or bend tight grooves as with all other types of side interlocking piles.

In suitable ground a 1-in. diameter steam pipe may be used as the interlocking rod and a 1¼-in. diameter steam pipe used down

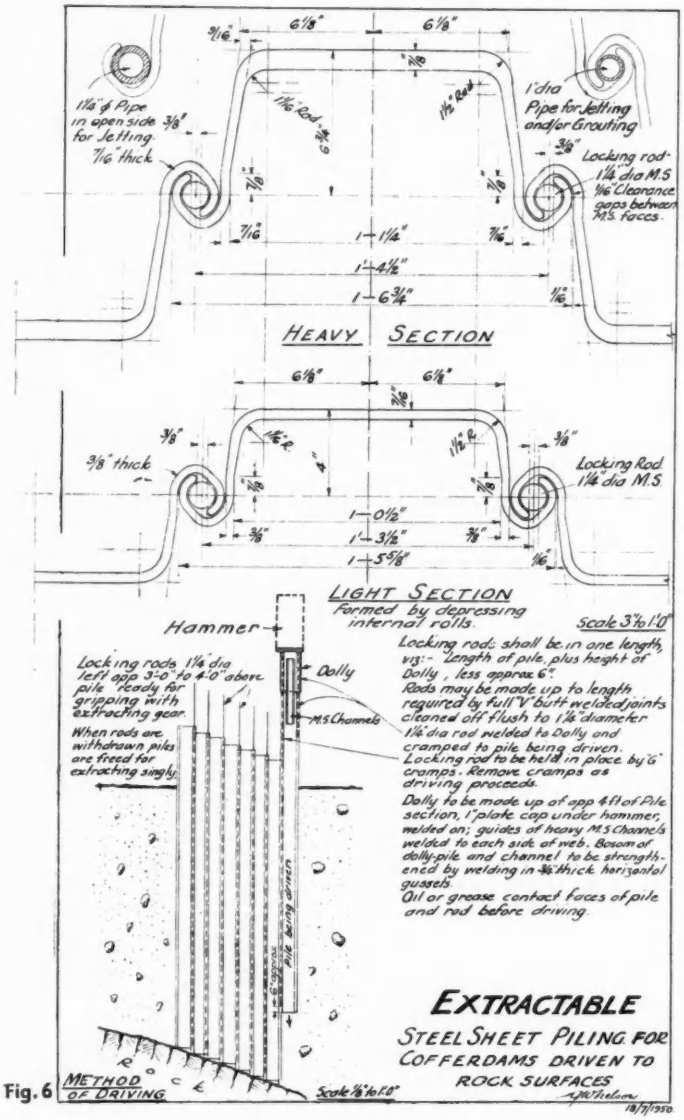

HEAVY SECTION
LIGHT SECTION
Formed by depressing internal rolls.
Scale 3"to1'0"
Hammer
Dolly
M.S Channels
Locking rod: shall be in one length, viz:- "length of pile, plus height of Dolly, less approx 6".
Rods may be made up to length required by full "V" butt welded joints cleaned off flush to 1¼" diameter.
1¼" dia rod welded to Dolly and cramped to pile being driven.
Locking rod to be held in place by 6" cramps. Remove cramps as driving proceeds.
Dolly to be made up of app 4 ft of Pile section, 1" plate cap under hammer, welded on; guides of heavy M.S Channels welded to each side of web. Boom of dolly-pile and channel to be strengthened by welding in ⅜" thick horizontal gussets.
Oil or grease contact faces of pile and rod before driving.
Locking rods 1¼" dia left app 3'-0" to 4'-0" above pile "ready for gripping with extracting gear.
When rods are withdrawn piles are freed for extracting singly.
EXTRACTABLE
STEEL SHEET PILING FOR COFFERDAMS DRIVEN TO ROCK SURFACES
METHOD OF DRIVING
Scale ½"to1'0"

Fig. 6

the clutch roll on the open side of the pile, both coupled up to a pressure pump and used as jetting pipes to assist driving.

Pipes of 1-in. or ¾-in. diameter steam quality may be used down the clutch for grouting the bottom of the piles.

At Lake Tekapo, New Zealand, side interlocking piles had been driven in heavy gravel and boulder formation at the tunnel intake in the lake. Pile pulling proved so difficult that only one pile was extracted before all available extracting gear had been smashed. The piles were then cut off under water by gas-cutting at the lake bed, a costly and time-absorbing process following a great deal of abortive effort.

At Maraetai, New Zealand, only about one-third of approximately 390 tons of the sheet piles used in the cofferdam were recovered, it being impossible to extract any more. It was the same story at Mangahao, and at every cofferdam of any size where side interlocking piles were driven to rock surface.

These suggestions are put forward to provoke discussion and stimulate a little thought along the lines presented. There are many excellent commercial lines of sheet steel piling offering, such as the Larssen, that can be driven and extracted in situations *that do not include rock* or where cofferdamming down to rock surface is not required.

A contribution of real value to engineering would be made if, as the result of study along the lines suggested, some engineer devised a pile shape suitable for use in cofferdamming to rock and readily extracted, that would reduce the cost of this expensive work and raise the salvage of costly and valuable rolled steel sections.

Construction at Adabiya Bay, Suez (Fig. 7)

The outer end of the Adabiya Quay was stabilised by two cylinders, each 41-ft. 6½-in. diameter, constructed of No. 5 Larssen steel sheet piling 60-ft. long, bound externally, circumferentially, above low water, with a welded band of ⅞-in. thick steel approximately 12-in. wide cut from the webs of Larssen No. 5 piles. These cylinders were constructed around preliminary staging of timber piling driven by floating plant, and the survey marks were accurately located on the staging (within practical limits) by instrumental intersection from shore marks. Filling the cylinders with layers of rock and topping off with 3 to 4-ft. of concrete at quay level was completed as early as possible, as they established the ranging marks and provided additional attacking points for employing extra units to drive the sheet piling.

Steel Sheet Piling

The steel sheet piling in the lighter quays were mostly No. 2 Larssen 60-ft. long, and in the deep water quay No. 5 Larssen. The sheet piling was driven from the floating plant, which, because of the depth of water, did not require very high frames. Alignment was kept by driving the piles between guiding timbers bolted, "leapfrog" fashion, to the driven piles, and was kept remarkably straight.

In the lighter quays, the piling was tied back to continuous concrete anchor blocks built on filling carried to a sufficient height for casting them and allowed to batter off towards the piling. After the tie rods were placed and filling around the block consolidated the rods were then tightened up and the filling completed.

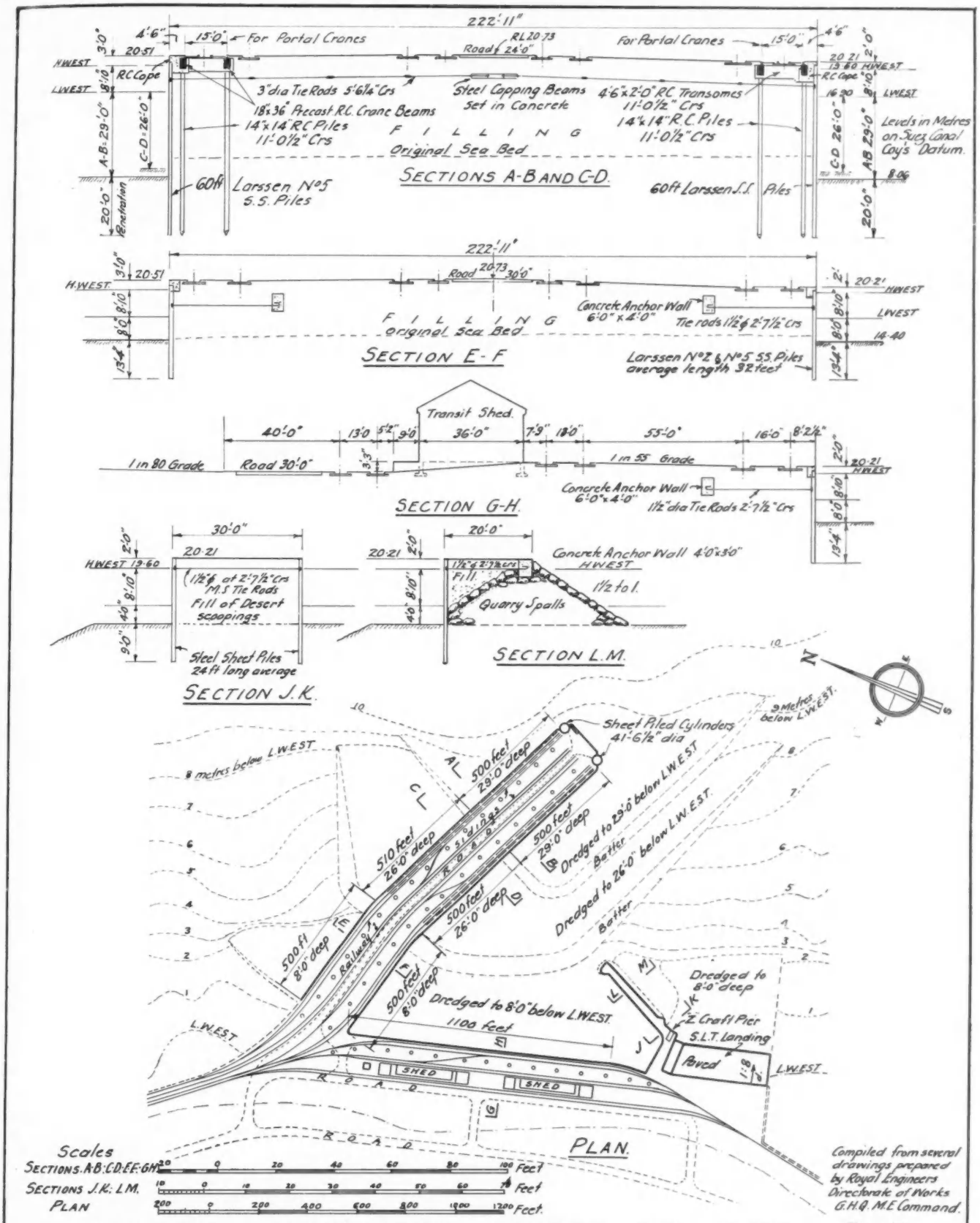
Because of the amount of filling to be done between the sheet piled walls of the deep-water quay, it was necessary to place the tie rods as early as possible. These rods crossed the 223-ft. width from piling to piling. To facilitate this work, the filling was carried out in such a manner that a central roadway at the tie-rod level was first made by end and side tipping material gained from levelling the land areas at the back of the quays. This roadway was progressively widened each side until the natural batter approached the piling at the original sea-bed level. The rods were then placed, tightened up, hot bitumen coated, served with hessian, then hot bitumen coated again.

The central junction was made by bolting the rod ends into "steel capping beams," which, after all adjustments and painting were done, were set in concrete.

(The capping beams were of mild steel approximately 17-ft. 6-in. long, made of two 10-in. x 3½-in. R.S. channels set with spacers about 14½-in. apart, having a pocket at each end on 15-ft. centres, plated over for resting on the top of the 14-in. x 14-in. R.C. piles. The original intention of these beams was to drop them over the tops of the piles as transomes and cast the continuous concrete crane beams on top. They were also to provide supports for concrete stiffening transomes between the concrete beams. These steel units were used for many purposes, and the above-stated junction between the tie rods was one.)

Concrete Piling and Crane Beams

As at Kad-el-Marakeb and Safaga, the 14-in. x 14-in. R.C. piles, varying in lengths from 35 to 60-ft., were driven at 11-ft. 0½-in. centres in the direction of the quay face, and at 15-ft. centres transversely. These piles were driven off temporary timber staging on timber piling. Several types of pile-driving jigs



HARBOUR CONSTRUCTION ~ ADABIYA BAY ~ SUEZ Fig. 7

G.W.N.

Deepwater and Lighter Quays—continued

were used, and one, known locally as the "juggernaut," was a cantilever frame fitted with a travelling head which enabled two piles to be driven 15-ft. on transverse centres in the one set-up. The hammers used throughout for steel sheet piling as well as R.C. piling were single-acting steam units of between three and four tons, but occasionally the familiar drop hammer was used when other hammers were not available.

To expedite the work at this wharf, the R.C. crane beams were precast in units 22-ft. long, 18-in. wide, by 3-ft. deep. These were lifted, transported and placed into position by a floating crane. They were supported at 11-ft. 0½-in. centres on transomes 4-ft. 6-in. deep and 2-ft. wide, the pile heads being stripped and reinforcement bared for incorporating in the transomes.

Dredging and Filling

Fig. 7 shows the extent to which the sea bed was dredged to provide the necessary depths. The material was mostly sand and sea muds. Such dredgings as would provide satisfactory and stable fillings were dumped or pumped into the quay area. Materials such as sea muds that would not consolidate with an angle of repose of 30 degrees or better were dumped out in the bay into deep water. All dredging was done by the Suez Canal Company on the cubic metre basis.

Approximately 400,000 cu. yd. of filling in the lighter wharves and in part of the deep water berthage were used.

Road and Rail Services, etc.

The railway sidings were constructed by a company of the Royal Indian Engineers. Several wharf cranes were installed, and one 15-ton crane was located about central in each side of the deep-water quay. In the port control and signal station building, ground floor, was installed a diesel-generating set for electric lighting and for operating electric capstans.

The approach roading from Ataka, about 1½ miles, was laid down to New Zealand Highways Board specifications, having base course and top course metal, water bound with fillers in typical manner. The surface was primed and sealed, and proved to be the best piece of roading in the Canal and Suez area.

Two transit sheds for the protection of valuable and removable stores were erected, each about 120-ft. long by 36-ft. wide.

Construction at Safaga, Red Sea

The construction was similar to that carried out in Suez Bay. Contracts were let for some parts of the work to Egyptian engineering contracting firms.

Most of the steel sheet piling in the lighter quay was driven by a No. 7 McKiernan-Terry double-acting hammer, steam-operated, whilst the 60-ft. Larssen No. 5 piles were driven by 3 to 4-ton single-acting steam hammers. A drop hammer about 2 tons weight was used for a short time on the lighter quay piling. The pile frames, winches, etc., used on the 60-ft. deep-water quay steel sheet piles were the standard types of the British Steel Piling Co., and were very satisfactory. The rigs were travelling units mounted on flanged wheels, which ran on rails supported on joists spanning the crane beams. Driving was varied, particularly on the deep-water quay, where coral was encountered in the ground penetrated.

Concrete Piling and Crane Beams

The line of the deep-water quay was for some distance in about 6 to 10-ft. of water, so floating plant was used to drive most of the 14-in. x 14-in. R.C. piles required to support the crane beams. Filling the beach areas out to the line of the piles was carried out as quickly as possible, so that the continuous concrete crane beams could be boxed and poured quickly.

Many of the piles were entered by jetting them down a few feet, then driving them to the required set. The pile heads were stripped in the customary manner to include the reinforcement in the beams and cross ties.

Anchor Blocks

The work on the anchor blocks was similar to that at Kad-el-Marakeb. About 1,000-ft. of caissons and 1,000-ft. of the steel piled type were put down. Corrugated iron was used for boxing caissons. A drop hammer (about 2 tons weight) was used to drive most of the piles for the anchor blocks of type A.

The work on these blocks was not completed, as the movement of the war away from Egypt made it unnecessary.

Dredging

The dredge "Ronaldsay" was brought from Calcutta at considerable trouble and expense. It was operating satisfactorily at the northern end of the deep-water quay and had been in use for a few weeks when 4 a.m. one moonlit morning about August, 1942, a German torpedo bomber successfully sank the dredge in about 40-ft. of water with considerable loss of life. This loss was serious, as there was no dredge available nearer than Durban or Bombay without robbing the work at Suez.

A drag-line, 800-ft. drop-rope, excavator was then designed, and the manufacture of two such units was put in hand immediately. The mast was to be constructed of two 60-ft. Larssen piles welded together—box shape—and having 20-ft. sticks of 12-in. x 12-in. Australian hardwood inserted in each end to make the total height over 80-ft. from ground to head sheaves. The drag buckets were to be manufactured out of 1½ cu. yd. dragline buckets of a well-known make.

Most of this gear was manufactured and ready for erecting at the site, complete with winches. Tail anchor rafts with control winches and anchors were earmarked in readiness for the work when the tide turned at Alamein.

Hoppers suitable for receiving the dumped material and discharging it into barges were also in the design stage.

Withdrawal of Sixty Feet Steel Sheet Piling

Owing to the successful termination of the North African campaign, it was decided to salvage the steel sheet piling and tie rods and despatch them, with as much plant as possible, to India. All the necessary gear and extracting equipment, including jetting pumps, were sent to Safaga in the last week of British Army operation of the metre gauge railway from Qena to Safaga. A McKiernan-Terry No. 7 hammer and a Zenith extractor No. 120 were sent down, also material for manufacturing a 30-ton shearlegs on the crane beams for getting the necessary initial lift using the extractor. After the initial lift the pile was removed with the aid of an 80-ft. high B.S.P. pile frame, etc.

Conclusion

The whole of the engineering work was carried out, in the Middle East, under the direction of the Director of Works, G.H.Q., M.E.F., the Docks Construction Branch of the Directorate being directly responsible.

Construction work at the sites was under the administration of the Commandants Royal Engineers Suez and Safaga and units of the Corps of Royal Engineers, the New Zealand Engineers and South African Harbour Construction Corps carried out the actual work assisted at some sites by Egyptian civil engineering contracting firms.

The writer was Staff Officer, Royal Engineers, Designs Officer I, at G.H.Q., M.E.F., for the whole construction period.

Developments at the Port of Gothenburg.

Speaking at a meeting in Gothenburg recently, Mr. Stig Axelson, port director, said that the appreciable increase in oil imports had necessitated considerable additions to the oil harbour, and the newest extension, the Skarvik harbour, still in the project stage, was to include a cleaning station for tankers undergoing repairs.

The Port of Gothenburg handles 27 per cent. of Sweden's total foreign trade, or goods valued at about Kr. 5,000,000,000 (£348 mn.), and during the past five years the City had invested no less than Kr. 53,200,000 in port extensions and improvements.

The import of fuel oils, amounting to 2,000,000 tons annually and constituting one-third of Sweden's requirements, had grown by 350 per cent. since before the war. On the other hand, imports of coal and coke had decreased by 55 per cent. The steadily increasing merchant fleet—600,000 tons registered in Gothenburg—had contributed to the development of the port.

Apapa goes on the map

A new town named Apapa now stands where once there was only a mangrove swamp. At Lagos, Nigeria, British West Africa, the Westminster Dredging Company played a prominent part in the transformation by reclaiming an area of 750 acres of unproductive marshland. On the site they prepared, modern housing schemes for both Africans and Europeans are fast taking shape. To speed operations, an all-electric prefabricated ground suction dredger was assembled on the spot and used in clearing adjacent creeks, dredging a new canal to a width of 200 feet and pumping approximately 5,000,000 cubic yards of sand to the site. The entire reclamation scheme was undertaken by contract with the Lagos Executive Development Board arranged by the Crown Agents for the Colonies.

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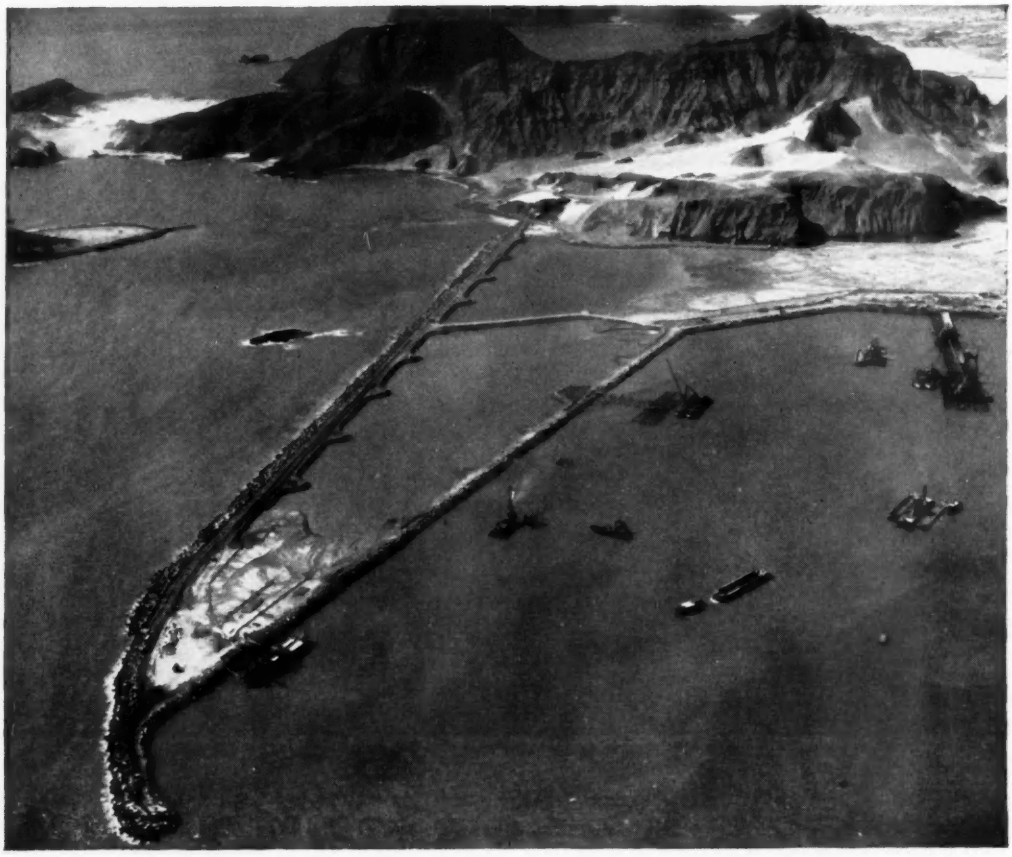

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Further large scale dredging and reclamation operations are now being commenced by the Joint Companies on behalf of the Aden Port Trust as part of the Port Improvement scheme.

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The Functions of a Port Authority

An Article for Students

By D. G. E. KENT, A.M.Inst.T.

(We print the following article in the expectation that it will be of interest to students and newcomers to the various fields of Port Working and Administration.—Ed.)

From the time when man first sailed the seas in some form of vessel, the master or owner would bring his craft to land in some sheltered spot on the coastline, or in a cove or river estuary—at least somewhere which provided a protection from the sea and wind and weather.

As some of these spots began to be populated, the movement of goods into and out of them became commonplace, and, in time the natural protection afforded to the original sea-farers was found to be inadequate to satisfy the requirements of the increased shipping. Consequently, local people provided protective works such as breakwaters or sea walls to give a greater degree of shelter. These places then became harbours, or, places of refuge wherein vessels could lie in greater safety than off shore, and in which they could better load and discharge their cargoes.

Subsequently, it became necessary for the harbours to be equipped with facilities for the more expeditious handling of ships and their cargoes. Trade was increasing, and traders were demanding better facilities. Consequently, quays, wharves, jetties and dock systems were provided, and while these were adequate for the ships there was still difficulty in moving the cargoes. The quays, etc., were therefore equipped with trucks, wagons, cranes, and derricks. Thus terminal facilities and services for shipping were provided, and so ports evolved.

These "terminal facilities" and "services" must obviously involve numerous operations by numerous bodies, all of whom contribute to the efficient operation of the port whereby ships and their cargoes can be handled with the utmost despatch and efficiency.

With this brief summary, therefore, it is proposed to give an outline of some of the functions of the many organisations so necessary to the successful operation of a major port. All ports differ, but it is usual to find some of these organisations in some form or other at all of them. The story of each will be brief, and should form but the basis of any future study of port operation.

Duties of Various Organisations.

The most important organisation within a port is the Port Authority, but it is proposed to deal with a number of smaller organisations first so that the great responsibility of this authority may be more easily appreciated.

There is, then, the Conservancy or Harbour Authority whose duty it is to maintain the river and/or estuary in a state adequate to ensure safe navigation. It must also maintain the river embankments, training walls and mark the river channel or port entrances by adequate buoys, lights, beacons and other markers. It will also sound and survey the river or port area from time to time to provide the data for the navigation charts of the port.

Next, there is the Dock Authority owning and operating a dock system within the port, in some instances quite distinct from the Port or Conservancy Authority. It is not usual, however, to find a Dock Authority as well as a Port Authority in the same port. Frequently also, there are separate river wharves and frontages owned and operated by private firms but such concerns seldom operate dock systems. The huge expense of dock construction has largely eliminated private enterprise in this respect and has precluded in most countries the construction of new dock systems by small concerns.

There is also the Pilotage Authority which provides the pilots necessary for the movement of vessels into, out of, and within the port. This is generally a separate undertaking with a Board of Management comprising representatives of shipowners, port and conservancy authorities and pilots. It has powers to license and train pilots, fix rosters, apportion earnings and to determine pilot rates and charges.

In some ports, owing to the intricate nature of the navigable channel, vessels are compelled to take on board a pilot, but at others pilotage is not compulsory.

Towage is a vital service within a port and is usually in the hands of private firms. In enclosed dock systems, it is sometimes the practice for the Dock Authority to provide its own tugs for the towage of vessels within its own system of docks.

The smaller organisations within a port include the stevedoring firms, the National Dock Labour Board which provides the dock labour, shipowners and their representatives or agents, brokers and forwarding agents. Road haulage and barge and lighterage firms all contribute to the movement of cargoes. Terminal facilities are greatly enhanced by the ship repairing firms which occupy strategic sites in the port and the victualling firms which are found in close proximity to the quays and docks. The Port Health Authority, generally the responsibility of the local riparian authority, is a most important defence against the import of contaminated cargoes, and the pests and diseases liable to be carried into the country by ships and their crews.

Lastly, but by no means least, there is the Custom and Excise Service—searching cargoes, and levying duty charges.

It will be appreciated, therefore, that there are many organisations involved in a port, but the Port Authority is as complex as all the other organisations put together. The Port Authority, the constitution of which is usually governed by an Act of Parliament, generally comprises representatives of shipowners, traders, payers of dues and charges, governmental and local interests.

Duties of the Port Authority.

The Port Authority so formed has as its function everything that may be necessary for the creation, maintenance and expansion of the port, the working of its system and the control of its affairs.

Its primary duty is the operation of the system of docks, quays, transit sheds, warehouses, dry docks, railways and sidings, roads and waterways which constitute the port.

For the satisfactory operation of its undertaking the Port Authority provides the equipment and appliances for the handling of cargoes. This equipment comprises among other things cranes, hoists, elevators, wagons, trucks, conveyors, timber carriers, balers and shunting engines. As the mechanical handling of cargoes increases, so the equipment provided increases, and it is one of the difficulties of a Port Authority to decide the economic charges to be levied for the use of this equipment.

Either directly or indirectly (i.e. by licensing) the Port Authority controls the technical and labour staffs which handle the vessels within the port, the loading and discharging of cargoes and the embarkation and disembarkation of passengers.

The technical side comprises the engineering staff, suitably apportioned between the civil engineering work, i.e. maintenance of roads, railways, buildings, etc., and the mechanical and electrical staff dealing with the mechanical equipment of the port. Improvements and developments within the port inevitably originate on a drawing board in the Port's Engineers' Department.

The technical operating side, comprising the dock or quay superintendents, wharf or quay foremen, quay, shed and warehouse labour, clerks, checkers, tally clerks, samplers, coopers and many others, is concerned with the vital job of moving cargoes.

The administration or clerical staff comprises delivery clerks, Customs' clearance clerks, and the accounts and ledger office clerks. There are also men who are engaged in special operations peculiar to a particular type of commodity such as the samplers of various commodities, the coopering and packing staffs, and those experienced in the handling of delicate curios and works of art, tobacco, silks, wines, spirits and carpets.

The Port Authority may also undertake extensive warehousing business with the specialised staff to deal with different types of commodities.

Two other important officials in port operation are the Harbour Master and the Dock Master. The Harbour Master is the marine adviser to the management and is responsible for the safe movement of the shipping using the port, and for ensuring compliance with all bye-laws and regulations relating to the movement, navi-

Functions of a Port Authority—continued

gation, mooring and behaviour of ships whilst in port. Similarly, the Dock Master performs these duties in his own particular domain—the dock system. With his staff of lockmen, he ensures the satisfactory operation of the entrance locks, swing bridges and other marine facilities within the dock.

The Port Authority may, in some instances, be responsible for the work of the conservancy of the port. These duties involve all that is necessary for the maintenance of the river, estuary and approaches to the port to ensure adequate and satisfactory navigational facilities. If the size of vessels using the port increases, then the Port Authority, if necessary, must make special arrangements to deepen the channel and approaches. One example may be given which provides a vivid illustration of this responsibility: up to 1882, the main channel to Southampton remained in its natural state, but deepening became necessary as steam navigation developed. The movement of the White Star Line services to Southampton in 1907 necessitated the further deepening of the channel to accommodate the larger vessels. The coming of the Cunard Line with the "Aquitania," "Mauretania" and "Berengaria" necessitated even further deepening and finally a five-year dredging programme provided a navigable channel for the mighty "Queen Mary" and "Queen Elizabeth."

Dredging of the approach channels and berths is a most important duty of a port authority, requiring regular or special dredging operations, and the disposal of the dredged material. In many places the material is pumped or conveyed ashore to reclaim land or, alternatively, it is carried to deposit grounds some distance out at sea where it is dumped, to disperse over natural deeps or hollows in the sea bed. At some berths, it is sometimes necessary for the river or estuary to be dredged to an unusual depth, e.g. an oil tanker berth, and the Port Authority will here provide the special dredging.

Coupled very closely with the dredging work is the sounding and surveying of the river, estuary or dock system. This is carried out by trained personnel who plot the actual depths, and from the data obtained, sounding charts—forming the basis of the navigation charts—are prepared. Sweeping operations to locate obstructions are also carried out.

Another important duty is the provision and maintenance of the navigational aids within the port, such as buoys, lights and beacons. An authority also has the responsibility of locating and removing wrecks interfering with safe navigation. The salvaging of the "Empress of Canada" in Gladstone Dock by the Mersey Docks and Harbour Board is a recent example.

The loading and discharging of ships may be performed by the Port Authority or alternatively by shipping companies or contractors, depending upon the practice in the port. Similarly, lighterage and cartage operations may be carried out by the Authority, and it is customary for the railway system within a port to be operated by the Authority up to suitable exchange sidings where the state Railways assume responsibility.

The prevention and detection of crime within the port area is often directed by the Port Authority's own police force, e.g. in London there is a police force to patrol the dock systems, and to check the entry and exit of vehicles and wagons to and from the docks and warehouses. The police have within their own areas the same authority as the Civil police and, in London, also within one mile of the P.L.A. boundaries.

Another important duty of the Authority is to make and enforce Bye-laws for the proper functioning of the port. These Bye-laws made under various Acts of Parliament apply to such matters as the carriage of petrol, conduct of vessels and crews within the port, especially where dangerous cargoes are concerned, and general Bye-laws for the conduct of all persons whilst within the area of jurisdiction of the Port Authority.

Types of Port Administration.

It will be realised, therefore, that the function of a port authority is both involved and complex and the position is sometimes further complicated, at least to the student, by the differing types of port administration. For example, in the United Kingdom we have some ports operated by the Docks and Inland Waterways Board of Management on behalf of the British Transport Commission. These ports comprising, in some cases, vast dock systems, are the old railway-owned ports—originally the terminal points of rail systems, e.g. Hull, Southampton, Cardiff.

Then there are the Municipal ports such as Bristol and Preston which are provided, maintained and operated by the local Municipality through a committee appointed by the Town Council.

There are no State-owned ports in the United Kingdom, but this type of management is found abroad, i.e. in South Africa, Egypt and France.

Some smaller ports are owned and operated by private companies—Granton in the Firth of Forth is one example. This port was originally built by the Duke of Buccleuch and is now controlled by Granton Harbour Ltd.

Then, probably the most important of all, there are the Trust Ports. The outstanding example is London—a self-governed or autonomous port authority with representatives forming a Board, drawn from the users of the port and the payers of charges in the port. This port is controlled and operated by a non-profit making organisation, and is actively keeping pace in its developments with world wide shipping requirements, and so should retain its premier position among the world's harbours.

Port Finances.

Now a few words about the financial side of port working. Under particular Acts of Parliament, a Port Authority is entitled to levy dues and charges on all vessels and their cargoes both entering and leaving the port. This has been a method of providing an income for the harbour authority for many years. These charges are usually based upon the net registered tonnage of the vessel and the gross or net tonnage of the cargoes.

The revenue obtained from these charges—Port Dues—is considered to repay the costs of providing and maintaining the waterway of the port. Dock and quay and jetty dues—Dock Charges—are applied to the vessels using these facilities and recompense the Authority for their provision.

When goods are landed or loaded further charges are levied for the use of the quay, wharf, shed, warehouse, cranes, gear and so on and any especial operation performed on the goods are also chargeable.

These various charges supply an income to the authority whereby it can meet the costs of the facilities provided and also pay for the complex organisations and functions outlined.

The equity of charges is a difficulty well known to port managers, but the happy medium—so very difficult to gauge—is that charges should not be so high that they deter would-be users of the port, and nor so low that the authority functions at a loss.

This account of the many functions of a port is of necessity, much abbreviated, but those who wish may delve deeper into the individual activities of port working by reference to the more detailed manuals which are available.

Portable Dredger for Columbia.

Allied Shipbuilders Ltd., Vancouver, B.C., have completed building a dredge which has been constructed in sections so that it can be taken apart quite readily and shipped by railway or truck to points of operation and there reassembled.

The problem of locking the separate pieces together was solved by positioning man holes on the deck of each part, and in proper relation, so that the mechanics can get down inside each part or section, and bolt them together. To ensure water tightness, special rubber gaskets were provided under each of these bolts' heads, and under their respective nuts.

The dredge is of all steel construction, and is equipped with diesel engines developing 975 h.p. It has an overall length of 70-ft., with a beam of 27-ft. and a depth of 5-ft. when fully loaded. When separated in its component parts, there are five sections measuring 25-ft. by 9-ft. by 5-ft. in depth, and two others measure 17.6-ft. by 9-ft. by 5-ft. None of these is too large or too heavy to be carried by railway truck, or by a powerful lorry and trailer.

The vessel was designed for the Canadian Government primarily for work on the Okanagan Lake, which is to be lowered by 3-ft., by straightening and deepening the Okanagan River. When completed, the lowered level will, in effect, provide storage space for the huge runoff which invariably occurs in the Spring of each year.

The New Dry Dock in the Port of Naples

Adaptable Compartments for Large and Small Vessels

By FORTUNATO GANGEMI,
Chief Civil Engineer of Harbour Works.

As far back as 1932 the construction of a large dry dock was decided upon. It was recommended to be of an adaptable type to take large vessels up to 1,100-ft. long and, as necessary, to also provide accommodation for small vessels. The main dimensions were eventually settled as follows:

Extreme length between faces of external walls: 1,148-ft.
Maximum effective length between insides of outer gates: 1,105-ft.
Normal working length between outer gates: 1,040-ft.
The sills were arranged to provide, the several lengths of
Western compartment: 176-ft.
Middle compartment: 470-ft.
Eastern compartment: 406-ft.
Second Eastern compartment: 877-ft.
The depth on sill at low water 42.6-ft., and the entrance width was 131.2-ft.

These dimensions were to be obtained by the provision of two intermediate gate sills to divide off the compartments as required. There were to be two outer entrances in deep water to allow draught of 42.5-ft. at mean low water. The tidal range is negligible but varies slightly with winds and seasons. To achieve the construction of a dock of this size and adaptability it was decided to site it at the tip of Cesario Console jetty, aligned obliquely across the line of the latter, so that one entrance would be in the Armando Diaz Dock and the other, the main entrance, in the outer harbour in the shelter of the San Vincenzo Mole. A wide area was to be built on both flanks for workshops and fitting out quays (see Figs. 1 and 2).

Already there were two existing dry docks, 662 and 366-ft. long respectively, besides a large slipway, therefore the projected new dock was arranged to deal with vessels that would be too large or too uneconomical for existing facilities. After careful analysis of shipping demands in the past and consideration of the future trends of shipping, and also competitors, the most profitable proportions of partitioning were arrived at as given above. Not only were the lengths considered but also the draughts and breadths, which of course is reflected in the cost of pumping and the time taken.

The dock cross section is designed as a monolithic mass of concrete in the form of an inverted portal with a floor of graduated thickness as shown in cross-section. Professor G. Krall was entrusted with the main calculations. Two methods were used, one the classical method based on the ratio of the reaction of the sub foundations to the resultant vertical forces (weight of structure, weight of internal water, hydrostatic uplift, components of the pressure due to the friction with the ground on the side walls); the other method was devised by Krall himself in which he based the

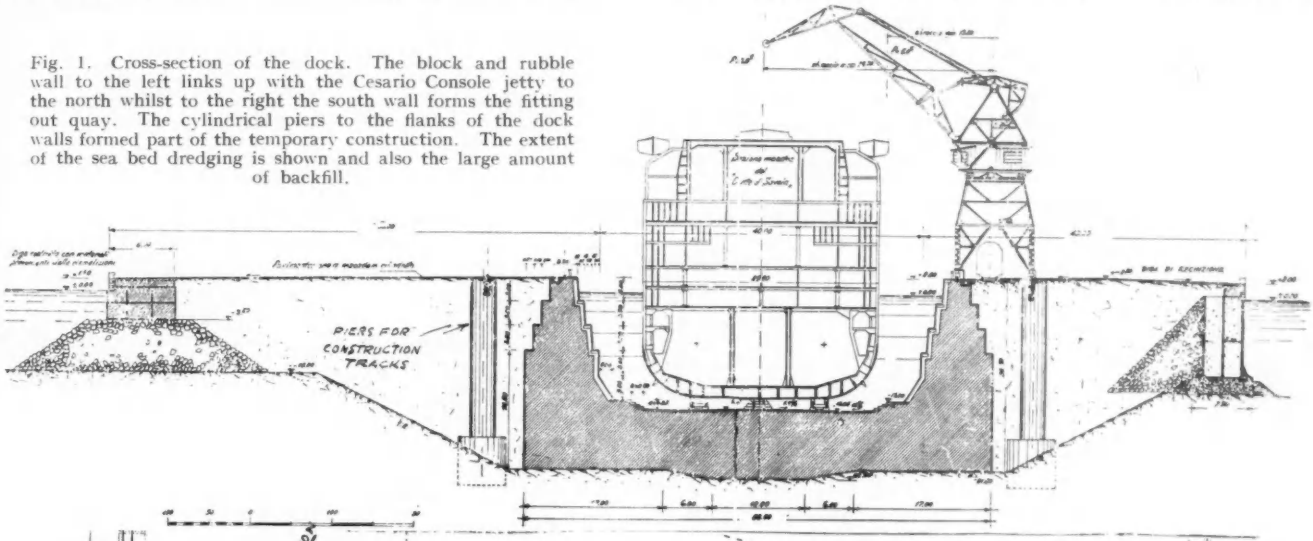


Fig. 1. Cross-section of the dock. The block and rubble wall to the left links up with the Cesario Console jetty to the north whilst to the right the south wall forms the fitting out quay. The cylindrical piers to the flanks of the dock walls formed part of the temporary construction. The extent of the sea bed dredging is shown and also the large amount of backfill.

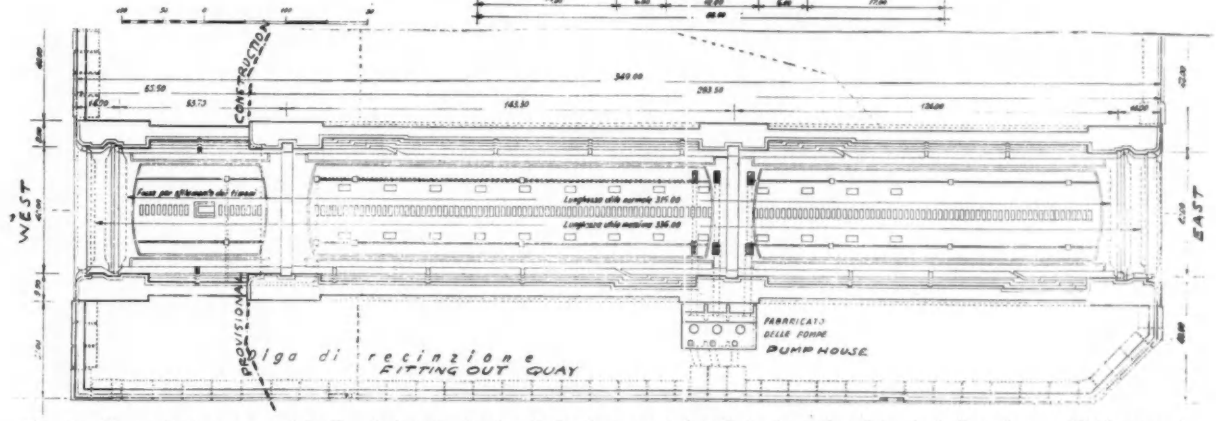


Fig. 2. Plan of dock as originally designed. Lack of funds caused length to be reduced to dash line shown (293.5 metres).

New Dry Dock in the Port of Naples—continued

calculations on the elasticity of the sub-foundations after having experimentally determined beforehand the co-efficient of elasticity.

The difference resulting between both methods was actually inappreciable due to the relatively great thickness (32-ft.) of the dock floor. Despite the sturdiness of the floor it had an elasticity such that the deflection was computed to be 5 mm. and therefore resulted in a reduction of stress about the centre line. To avoid discontinuity in the pressure on the sub-foundations it was found convenient to construct the full overall width of floor slab and then to construct the wall subsequently rather than to limit the floor to the central part only and then to construct the walls afterwards. After careful study and computations of all known factors it was decided that the best results would be obtained in construction progress by the following sequence: construction of the floor slab; construction of the walls; construction of the buttresses, and head, and then the emptying of the basin to complete the internal facings, etc. The whole of the work was designed with ample reserve of stability by ensuring light stresses throughout and also introducing steel reinforcement in the slab to carry any excess of tension stresses, not only due to plastic adaptation but also to cover the prolonged period of curing of the large masses of concrete poured.

Construction.

The preliminary work on site involved the clearing of old port works and quay walls, and required considerable labour in the demolition of about 700 lineal yards of block wall and 200,000 cubic yards of rubble on the sea bed. This was followed by dredging and transporting out to sea 600,000 cubic yards of bottom mud and sand from the existing bed at 30-ft. to 77-ft. below low water.

A most important part of the preliminary temporary works was the installation of the fixed and mobile plant for the placing of the concrete by compressed air in the floor and walls. It was of paramount necessity for the safety of the works, efficiency, and accuracy, to have all parts of this working system placed as designed, requiring as few construction joints as possible, and to obtain the greatest continuity that modern plant and ingenuity could devise.

The importance of continuity and the necessity to reduce construction joints to a minimum lies in the fact that subsequently the latter may possibly serve as channels of infiltration under the breathing action of the emptying and filling of the dock; besides the sandy nature of the Naples harbour sea bed did not offer any prospect of reduction of the hydraulic uplift due to consolidation of the sub-foundations.

The contractors proposed the construction of a large reinforced concrete caisson with overall dimensions of 198-ft. x 43-ft. x 19-ft., divided into 14 chambers, or compartments, of which 11 were for working chambers and three for kentledge, designed to execute the placing of concrete in the floor slab of 191.4-ft. x 37-ft. x 5-ft. 5-in. This caisson was suspended from a travelling steel gantry supported on tracks placed to the flanks of the dock walls and 16-ft. from them. The tracks were parallel to the centre line and were carried by a double row of R.C. cylindrical piers for the whole length of the dock (see Fig. 1) and were to be utilised later to support the inner track of the dock side crane.

The caisson was suspended by 34 steel screwed shafts operated synchronously by electric motors so that the vertical position, up and down, was under complete control for the execution of each layer of the floor slab placing. On the whole this arrangement gave good results throughout; minor difficulties intervened which were resolved with patience and ability of craftsmanship. The great advantage of this method lies in the fact that the safety of the men in the working chambers was assured and, in consequence, a good job resulted. In each placing the floor slab layers were poured for the full width of dock.

When the full height of floor slab was completed the caisson was moved on to the next placing. Then after a suitable period for curing of the slab, preparations were made to pour the walls. For this purpose a second similar bridge gantry was fabricated and employed. Suspended from this bridge there were two small caissons 59.3-ft. x 37.4-ft. x 14.76-ft. manipulated in the same way as the larger caissons. The joint use of these two gantry bridges was found most convenient as one followed the other without interference and also facilitated the continuous use of labour.

The whole of the material required for the temporary structure described above amounted to 1,500 tons of steel, 8,500 cubic yards high alumina cement concrete and 10,300 cubic yards of ordinary concrete, which amounted to only 5 per cent. of that required for the complete works. Part of this temporary structure was further incorporated in the main scheme.

When the war started only 12,000 cubic yards of floor had been laid. Work was stopped and recommenced nearly ten years later in 1948. There had been considerable damage done to the plant and the temporary works, including the caisson air chambers. Then lack of funds prevented continuance and it was decided to reduce the length to 293.5 metres similar to that of No. 4 Genoa dock.

Dock Plant.

After very careful and wide consideration with specialist consultants it was decided that the pumping plant best suited to the needs of the dock should be of the horizontal helical rotor type with vertical shafts. For the main pumping out of the dock, three large units would be employed and the minimum time for the exhaustion was fixed at three hours. The deciding factor in this was the reasonable minimum time required for the labour of trimming and adjusting side blocks. Besides the main pumps there were three smaller of similar pattern for dealing with in-

Fig. 3. Photograph of dock after first emptying. The temporary beams carrying tracks, and the compressed air wall caissons used in construction are also shown. The ship type dock gate is shown in position in forefront at the west entrance.

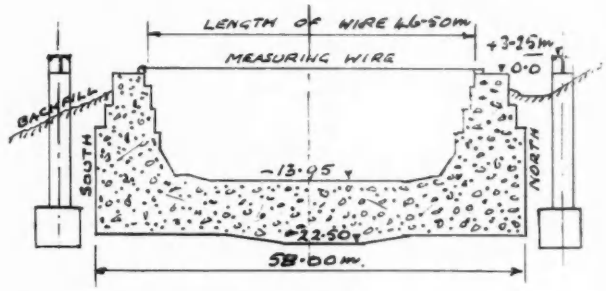


Fig. 4. Diagram showing method of measuring lateral deflection of walls.

filtration, and three of yet smaller capacity to clear the pump sumps. The pump galleries and valves were arranged to deal with all compartments separately as required.

For the electric power it was primarily arranged to use at 9,000 volts to save the cost of transformers but after prolonged consideration the decision was made in favour of 2,000 volts.

Dock Gates.

The type of floating gate selected was that proved already by experience at Naples and Genoa to be the most reliable and secure. This gate was originally designed on the results of the mathematical analysis of the structure by Professor Krall*.

The ship part of the gate is peg-top in cross section with a watertight deck at two-thirds the height of the gate from the sill keelson. Above this deck for the remaining third of the total height there is a steel bulkhead, substantially framed and braced, and pierced

* See "The Dock and Harbour Authority," p. 163, No. 396, Vol. XXXIV, October, 1953.

New Dry Dock in the Port of Naples—continued

by six apertures carrying large gate valves operated from the platform at dock side level, or electrically from the control room. It takes two hours to flood the dock. A secondary manner of flooding the dock is siphonage through the discharge pipes of the main pumps, where outlet is under water. For this purpose a specially designed rotor adaptation and snifting valves on the apices of the curved discharge pipes are fitted.

Keel and Bilge Blocks.

Originally, it was intended to use fixed blocks throughout but the success attending the use of hydraulically operated side blocks at Genoa to do away with the necessity of side shores to dock walls caused us to do likewise. The keel blocks were fixed in position but the two lines of lateral blocks just beyond the garboard strakes of vessels were operated hydraulically at 200 atmospheres giving a vertical travel of 12-in. in two minutes. Between these and the bilge a second lateral row of blocks were hand-operated by divers The hydraulic blocks are operated from the control room on the dock side where automatic gauges register the state of all items affecting the docking and the plant.

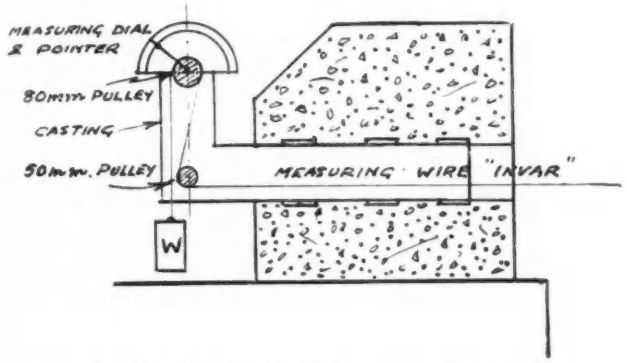


Fig. 5. Diagram of arrangement of measuring apparatus.

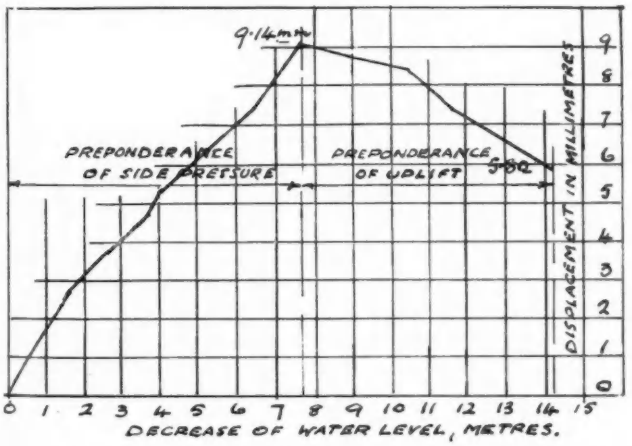

9·14mm
PREPONDERANCE OF SIDE PRESSURE
PREPONDERANCE OF UPLIFT
DISPLACEMENT IN MILLIMETRES
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
DECREASE OF WATER LEVEL, METRES.

Fig. 6. Graph of lateral deflections of walls plotted against decrease of water level.

First Emptying of the Dock.

During the first phase of emptying the dock it was decided to measure accurately the main deformations that would probably take place during the progressive relief of the dead weight of the contained water. At this time the concrete walls were completed to full height but internally the altar facings, etc., had not been commenced. also the back fill against the outer wall faces was only partially up to finished level on one side (see Figs. 3 and 4) and on the other opposing side it still required 18-ft. extra fill to bring to wall top level. However, a section 334-ft. from the eastern entrance was chosen for the transverse test, as at that point there was the maximum amount of backfill

On the top of the south wall a stout steel bar had been cast in a specially prepared block of concrete pinned to the wall itself, and on the north side, directly opposite, another block of concrete was also fixed in position. This block carried a metal casting (Fig. 5) and on a vertical projecting arm there were two small pulleys. A fine flexible steel wire of " Invar " quality had one end secured to the steel bar on the south wall and the other end passed round the pulleys on the north wall and weighted as shown. The shaft of the upper pulley carried a rigidly connected pointer which registered to the zero marking on the graduated dial at the head of the vertical arm before any pumping began.

The results of the test plotted from the readings on the pointer scale are shown in Fig. 6. This shows a peak deflection of 9.14 mm., when the water head had been reduced to 7.70 metres below external water level, under the predominating influence of the backfill and the external lateral hydraulic pressure. A further decrease of internal water level showed that the uplift pressure on the floor base then predominated and reduced the deflection of the walls towards each other by 3.34 mm., to 5.80 mm., when the water was completely evacuated to 13.95 metres (floor level).

Simultaneous measurements of vertical deflections due to the plastic effects on the sub-soil were recorded with precision instruments by Professor Madia of Naples University. For this purpose four metal pegs with spherical tops were set in the upper surface of each wall; one near the western entrance gate and, from this, at the following spacings, 70 m., 70 m. and 108 m. towards the eastern gate. The instruments were erected on the ground of the old quay wall, well away from any local effects resulting from the elastic recovery of the ground on the relief of foundation loading, due to the exhaustion of the water from the dock. The readings reduced to the zero reading with dock full were:

South Wall	8.43 mm.	11.35 mm.	13.23 mm.	9.60 mm.
North Wall	6.96 mm.	9.63 mm.	11.79 mm.	8.48 mm.

which show that the south wall is 1.4 millimetres above the north wall and that both walls are bowed to the sky.

It should be pointed out that the condition of the dock at this time was far from complete. The backfill against the northern wall still required 10-ft., and the southern wall 18-ft. to finished level.

Plastic Deflection.

It is clear that the elevation of the entire structure showed that the elasticity of the sub-foundation restituted in part the deformation due to the load. It is also probable that the difference between the top levels of the two walls was due to the difference of the heights of backfill. Again, the unfinished dock is short of much loading, altar facings and copings. In such circumstances the results are satisfactory. In the preliminary calculations for the dock in the finished state the bearing capacity of the ground was assumed to be 0.75 kg. per square centimetre (14½ cwts. per square ft.) but at the time of the tests it was considerably short of this value.

Regarding the longitudinal deflections towards the sky and the maximum value (4.3 mm.) at the intermediate sill, it is probable that this was due to the added deadweight of the floating gates on the external sills when the dock was emptied. It is computed that this represented a vertical loading at each end of the dock of 600 tons.

Considering that in the longitudinal sense the dock acts as an elastic beam supported for the whole of its length on the ground and subjected at its extremities to point loads, and also taking into account the great difference in value between the modulus of elasticity of the ground and that of the concrete dock, the relation between the length of the shell and its elastic length, must be greater than four.

However, if between the dock shell and the ground the friction drag is neglected the problem can be considered as two end lengths equal to the elastic length with triangular diagrams of pressure having their maximum ordinates under the point loads. Such a diagram of forces would represent the loading of a beam with a flexure convex to the sky. To determine the value of the deflection and to put it in relation to that obtained by the actual test is, in the circumstances, of tentative value only. There were several unknown facors and the one test was not sufficient to guarantee the

New Dry Dock in the Port of Naples—continued

reliability of the readings. The actual modulus of elasticity of the sub-soil, the distribution of the ground loading and the vertical components of the side ground pressure on the walls were uncertain.

We may, however, consider the dock as a U shaped beam lying on the ground and carrying end point loads like a railway sleeper stopped short at the rails.

Let L = 285 metres represent the length of the dock between the entrance gates.
P = 600 tons, the effective deadweight of each entrance gate, when dock is empty.
J = moment of inertia of dock section, approximately = 25,000 metres^4.
E_1 = modulus of elasticity deduced by experiment and based on the preliminary computations of the project. = 500,000 tons per square metre.
C = 0.75 kilogrammes per square centimetre, allowed ground bearing pressure, corresponding to
E_2 = 8,000 tons per square metre modulus of elasticity.

Then the equivalent elastic length is

$$l = \sqrt[4]{\frac{4E_1J}{E_2}} = 50 \text{ metres}$$

which gives the ratio $\frac{285}{50} = 5.7$ which is greater than 4.

For this value the diagrams of the reactions assume a triangular form with base = l = 50 m. from each extremity and maximum pressures under the point loads P = 600 tons.

Then the flexion in the centre deriving from this distribution and reactions shall be

$$\triangle = \frac{P(2l)^3}{6E_1J} = \frac{600 \times 100^3}{6 \times 500{,}000 \times 25{,}000} = .008 \text{ m.} = 8 \text{ millimetres} \quad (1)$$

During the process of emptying the dock the hydraulic pressure of the outside water against the gates and sills increased as the inside water level was lowered. This gave rise to an axial thrust over a total end area at each gate of 40 × 14 = 560 square metres, representing a pressure value of approximately 4,000 tons acting at a height of 10 metres below the outside water level and 12.5 metres above the base (22.5 m.).

As the centre of gravity of the dock section is 8 metres above the foundation level the eccentricity of this end hydraulic thrust is (12.5 − 8.0) = 4.5 metres. This then will provoke a bending moment of 4,000 × 4.5 = 18,000 tons/metres tending to develop a deflection contrariwise to that obtained by the expression (1). We may approximate to its value as follows, taking overall length of 293.5 m.

$$\triangle_2 = \frac{M L^2_0}{12 E J} = \frac{18{,}000 \times 293.5^2}{12 \times 500{,}000 \times 25{,}000} = .01 \text{ metres} = 10 \text{ millimetres}$$

so that theoretically the resultant vertical deflection should be (8.0 − 10.0) mm. = 2 millimetres below zero deflection, that is the dock wall should be bowed concave to the sky whereas from the test figures it is bowed 4.26 millimetres convex to the sky.

Considering the unfinished state of the dock and the backfill the result is satisfactory as there is little doubt when the altars are completed and the structure comes into normal use the measured deflection will be nullified. However, this rough approximation serves the purpose of showing that the structural stability of the shell on first emptying is favourable.

Watertightness of Shell.

The watertightness of the basin when pumped out was much greater than expected considering that over a considerable area of the outside wall surfaces the water was still in direct contact with the walls. The numbers of leaks were comparatively few, and the infiltration, in both the walls and the floor, was in no case considerable. This was no doubt due to the care taken in mixing, placing, vibrating and prestressing the top layer of concrete of the floor. Another factor that undoubtedly helped was the placing of a clay blanket on the external faces of the walls as part of the backfill. The more pronounced leakages were dealt with by cement grouting, and later when the altar faces and linings are laid, of granolithic concrete blocks in cement mortar, a high degree of dryness will be ensured.

R. R. M.

Correspondence

To the Editor of *The Dock and Harbour Authority*.

Dear Sir,

Working Costs of Steam and Diesel Shunting Locomotives

The points raised in the Editorial comments of the September issue of "The Dock and Harbour Authority" concerning the relative merits of steam and diesel traction for Docks Estates are very interesting, but I consider that a certain fundamental issue has been overlooked.

The only way of formulating a true and accurate comparison is to equate overall conditions. The true picture of economy, reliability and efficiency of diesel and steam traction should only be compared tractive effort for tractive effort, locomotive age for age, and against identical working and maintenance conditions. If this is not done, a very false impression can be created. The advantage of diesel traction as far as operating economy is concerned, is made to appear overwhelmingly favourable by the figures quoted in the editorial, but these should not be treated too literally as no comparison is shown between age, condition and site operation of the steam and diesel locomotives.

Without doubt, the only way to exploit the diesel advantage of all three factors mentioned is by the highest degree of maintenance together with the employment of the locomotive up to full load factor. There should also be a total absence of overloading.

To offset the balance against the diesel locomotive, resulting from the higher annual interest and depreciation losses caused by the difference in initial cost, maximum and continuous availability of the locomotive is essential. Before any annual economy can be shown in favour of the diesel by decreased operational costs, these higher interest and depreciation losses must first be worked off. Only then can one begin to talk in terms of saving. This factor is especially important in the case of the diesel electric locomotive, where power for power, the initial layout is in the region of 3½ to 1 against its steam counterpart.

Continuous availability and reliability can only be achieved by very positive maintenance, which should be applied on a strictly scheduled basis. The utmost care should always be taken to ensure that the diesel locomotive never has to be stopped for some costly and prolonged repair resulting through improper control on the part of either supervisory or artisan staff.

Only when this is achieved can the three points under comment be exploited to full advantage for the diesel.

However, it should be fully appreciated that there is no hard and fast yardstick that can be applied for comparing one locomotive to another even on an equable tractive effort basis alone. Each case must be treated purely on its own merits, as whilst a good one could be put forward for say a 200 B.H.P. diesel locomotive on one estate, due to completely different operating conditions prevailing, the picture could look completely changed for another.

It will be appreciated that the whole question cannot be dealt with completely in a few words, and it is suggested that a detailed reference to my several article in past numbers of vour journal should give a more comprehensive appreciation of the subject.

Engineer's Office,
Port of Bristol Authority,
Avonmouth Docks.
October 20, 1954.

Yours faithfully,
A. O. HELPS.
A.M.I.Mech.E., M.I.Struct.E.

Economical, versatile rubber fenders for docks, quays, harbours and piers

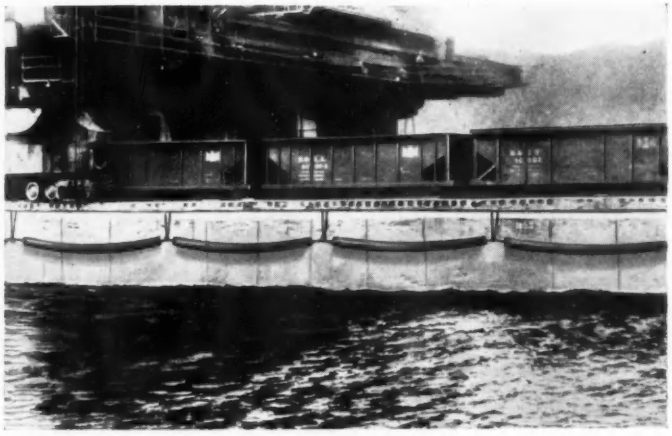
EXTREMELY high shock resistance is but one outstanding feature of Goodyear Rubber Fenders. It has an amazing capacity to absorb impacts of tremendous force without shattering, and the resilience to regain its original shape with efficiency unimpaired.

Its resistance to weather and abrasion is remarkable, too. An installation serving ore-laden freighters on Lake Erie has been in service over 20 years!

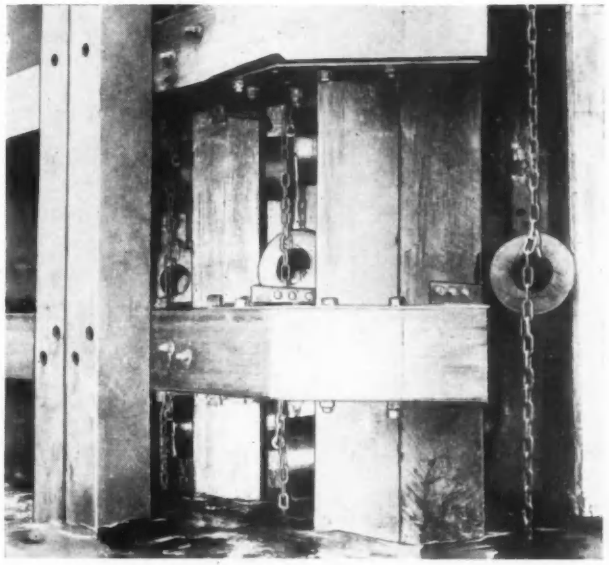
The versatility of Goodyear Rubber Fendering is no less important. It is a material that lends itself to efficient combination with other fendering materials (as shown by the installation at Dover illustrated here), yet may be used alone to provide effective protection.

LONG LASTING, LOWERS COST

In ports all over the world, Goodyear Rubber Fenders have shown conclusively that no other fendering is so thorough, saves more money all round or lasts for such a long time. Low maintenance and replacement expense makes the overall cost of Goodyear Rubber Fendering far lower than that of older, less protective methods or mechanical installations. This superior form of protection quickly pays for itself many times over in its long, gruelling life.



These Goodyear Dock Fenders were installed at the Pittsburgh & Conneaut Docks, Lake Erie on May 4th, 1933. They have seen constant heavy duty while docking Great Lakes ore and coal "freighters" — recovering from blows that long ago would have destroyed more common types of fender. After 21 years of service they are still in excellent condition.



The versatility of long-lasting Goodyear Rubber Fenders
This illustration shows them used in conjunction with other fendering material on dolphins at the Dover car ferry terminal.

Advantages of Goodyear Rubber Fenders

★ High Energy Absorption — Considerable kinetic energy can be absorbed without damage.

★ Eliminates mechanical shock absorbing devices.

★ Practically immune to the effects of abrasion, ageing, rotting, corrosion, etc. Gives completely satisfactory service under a great variety of climatic, tidal and operating conditions.

★ Easy to install. Simple to secure by cables, chains or bolts. May be installed horizontally, vertically or diagonally. The particular needs of every installation can be dealt with simply and effectively.

★ Low maintenance cost. Special compounded rubber ensures resistance to wear and all weathers. At a recent detailed examination of fendering in service for 15 years it was found to be as good as new.

★ Tough and resilient. Can compress up 1/3 of original thickness without damage.

★ Extremely adaptable. Depending on the type of structure, the impact to be absorbed and the operating conditions at the site, Goodyear Rubber Fenders can be used alone or in conjunction with other types of fenders.

★ Choice of section. Goodyear Rubber Fenders for dockside or ship are made in a range of sizes of circular and rectangular section. A specially neat D section is made for small craft.

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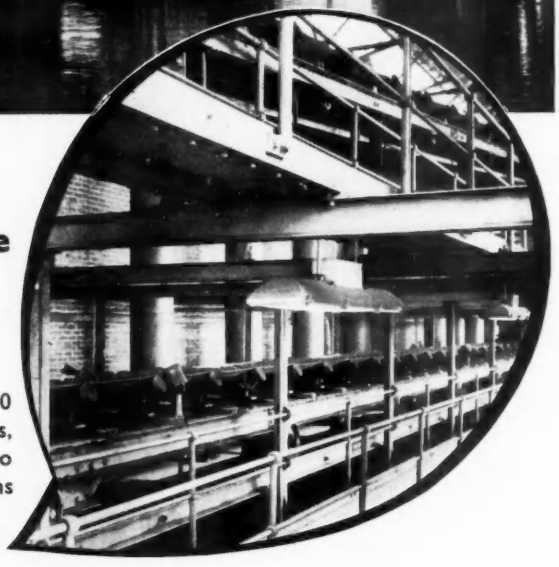

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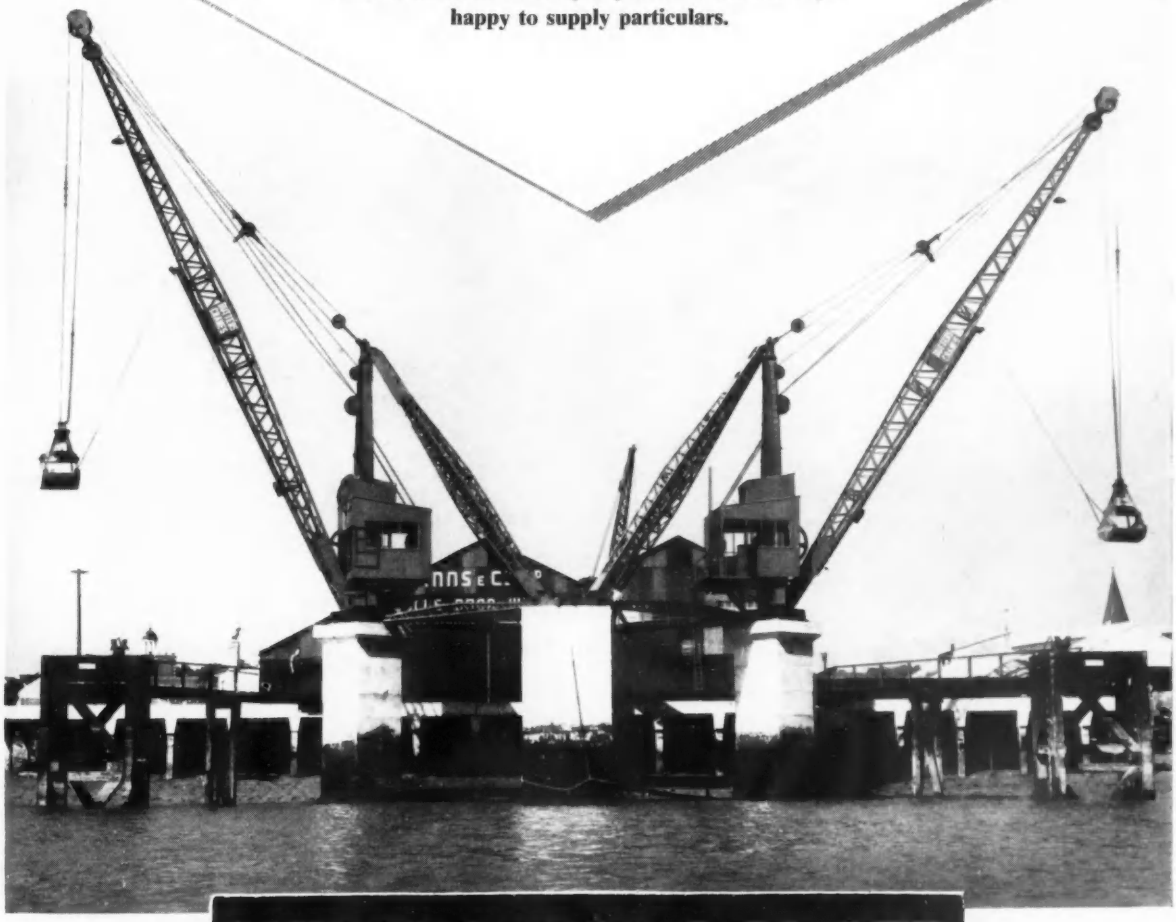

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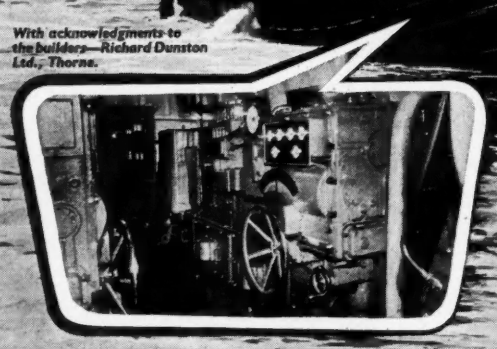

With acknowledgments to the builders—Richard Dunston Ltd., Thorne.

In the background is a vessel of the "Highland Monarch" class, having CROSSLEY-PREMIER vis-a-vis Diesel Engine compressor sets for refrigeration.

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Ship Repairing, Dry Docks and Taxation

Extracts from the 1954 Presidential Address of H. J. A. Silley, President of the Institute of Marine Engineers

The operation of repair and maintenance of ships is no new one to this country. It has its place in history since earlies times. We know that from time to time our country has been faced with problems relating to trade and defence, and that on many occasions our survival as a free people has depended on those of our countrymen who manned our ships and on those who laboured at home to keep the ships at sea. The twentieth century has seen our country engaged in two major wars, when shipping supplied the vital link between the sources of supply across the world of raw material and essential supplies as well as the food without which we might have been starved into submission. A survey of the shiprepairing position during the last war emphasises the extent to which the United Kingdom was dependent upon its shiprepairing facilities. At the commencement of the 1914 war the number of men employed in the private yards and in the Royal dockyards in the United Kingdom on shipbuilding and repairs totalled 132,000, and this number increased to over 220,000 at the cessation of hostilities in 1918. However, in consequence of the policy of disarmament adopted in the early 1920's and also due to the world recession in shipping, this number of men dropped steadily in the years between the two wars, and in spite of the rearmament programme which commenced in 1938 there was just under 157,000 available in our shipbuilding and repair yards at the outbreak of World War II—a decline of between one-quarter and one-third of experienced men.

	Royal dockyards	Private yards	Total
July 1914	40,662	92,144	132,806
November 1918	61,245	161,300	222,545
September 1939	37,023	119,666	156,689

The demand for replacement tonnage and shiprepairing soon overloaded the yards, and the numbers of men were increased rapidly until by 1943 the total had risen to 180,000, but of this total soon 40,000 were continuously employed on naval repairs. The remaining 140,000 was still inadequate to meet the heavy demands for building and repairs, and work on many merchant ships had to be deferred until after the war. The position would have been much worse if the United States had not, early in 1941, expressed its willingness to help with the repairs of H.M. ships. Between 1941 and September 1945, 180 H.M. ships were refitted and repaired in the U.S.A. The value of this relief to the load of work in the United Kingdom yards at this time cannot be overestimated.

The importance of drydocks as part of the essential services soon became painfully apparent to those who had the responsibility of conducting our maritime affairs, and one of the first steps taken by the Prime Minister was the setting up of the Offices of Controller and Director of Merchant Shipbuilding and Repairs. This new department acted in liaison with the Board of Admiralty and was in constant and daily contact with the War Cabinet. So important became the drydock position that their use was strictly controlled by the exercise of varied degrees of priority. With the steady assault of the enemy the demands for drydocks for the immediate repair of torpedo and mining damage became for the country as important as such matters as the output of fighter aircraft and bombers.

In 1939 the following drydocks were available in the United Kingdom:—

	Royal dockyards	Private dock
Graving docks	50	240
Floating docks	5	16

In Germany there were twenty-five graving docks and 130 floating docks. (As a matter of interest nearly 80 per cent. of the latter were sunk by Allied air attack).

Of the 240 graving docks in this country, only eighty-two could accommodate ships of over 57-ft. beam. Between 1938 and 1954 the number of ships over 57-ft. beam registered in the United Kingdom or on charter increased from 780 to about 1,580, whilst the number of drydocks available had only increased by five.

When the number of vessels of a beam of 80-ft. is examined, it is found that whereas those in that category will have risen in number from fourteen in 1938 to a probable eighty-one by 1957, the number of graving docks with an entrance width of over 85-ft. will have increased in that time by only two, i.e. from sixteen to eighteen.

The following tabular statement of the world position regarding large ships has recently been published:—

	1924	1952
Gross tonnage over 70-ft. beam	1,600,000	8,000,000
Number of vessels with beam of:—		
70-80-ft.	70	376
80-90-ft.	5	123
Over 90-ft.	5	11

This article commented that the private dock accommodation for such ships has not materially altered in the United Kingdom and as a result Britain's share in shiprepairing facilities in the world is decreasing.

From a detailed survey of the requirements of merchant shipping it is a matter of profound importance to appreciate that some 25-27 million gross tons of shipping are drydocked annually in the United Kingdom, and that of this total the major tonnage consists of ships requiring the larger drydocks. This tendency will undoubtedly increase as the smaller ships are replaced by fewer but larger ships.

Before 1938 the entrance width of a well-proportioned drydock was about one-tenth of its length. The beam of many modern ships, however, is some 20-ft. greater than for pre-war ships of similar length, and this has meant that the entrance width of some long docks has had to be increased.

As ships grow in size, so more and more drydocks in use become obsolete. The cost of building a large drydock is high, between £1,500,000 and £2,000,000, and it is a matter of interest to study the taxation aspect in regard to this large capital outlay for the construction of a drydock. The Finance Act of 1953 enabled industrial buildings to be written off in forty-five years, but expenditure on excavation, tunnelling, etc., was disallowed. The 1954 Act decreed that such expenditure should rank for an initial investment allowance of 10 per cent. but for no annual allowance. Although this was a step in the right direction it was totally inadequate to meet the cost of depreciation on the greatly increased cost of buildings and drydocks constructed to-day is compared with those prior to 1938. This factor has undoubtedly discouraged the building of new drydocks in anything like the numbers that might have been achieved if the various Chancellors of the Exchequer had given more sympathetic consideration to this matter of vital public interest.

It is interesting to compare the treatment meted out to the shipyards in England with that enjoyed abroad. In a recent interview the President of the Italian Parliamentary Merchant Marine Commission stated that a ten-year shipbuilding programme had been authorised in a new law approved in July last providing for a substantial government subsidy to shipyards "Subsidies are necessary," said Signor Angelini, "because shipbuilding costs are high in Italy and without Government aid Italian Shipyards would not be able to compete for foreign orders." The benefits to Italian shipbuilding have, of course, been reflected in their repair industry. Aid from the United States—especially under the Marshall Plan—has also played a vital part.

The present position of large drydocks shows how relatively small is the number available in this country in comparison with the rest of the world.

		Entrance width of drydocks Over 80-ft.	Over 90-ft.	Over 100-ft.
Great Britain :	State-owned	15	13	9
	Private	25	13	6
Commonwealth :	State-owned	16	13	7
	Private	15	10	7
U.S.A. :	State-owned	40	33	22
	Private	71	36	7
World's total		297	196	107

Ship Repairing, Dry Docks and Taxation—continued

Drydocks must be regarded as essential to the industry of ship-repairing, but there are many other services that must be available to make up the efficient unit. Shiprepair yards in the United Kingdom have, in general, been established for many years. They are situated mainly on congested rivers or harbour frontages and surrounded by towns, and any extension of area is extremely difficult if not impossible. To lay down a new repair yard with a deep water frontage and proximity to a supply of suitable skilled labour seems well nigh impossible under present conditions. It follows, therefore, that in the main the only means of increasing our ship-repair capacity is to increase the labour supply, to improve both plant and technique, and to make fuller use of the plant by overtime and shift work. Criticism of the industry is more often confined to the time taken for the work than to the cost, and rarely—if ever—to the quality of the work executed. The standard of workmanship in British yards will bear comparison with that of any of our world-wide competitors.

Shipyards rely very largely on the apprenticeship system to maintain the skilled trades. During and since the last war our ship-repair yards have been maintained at a high capacity, and in consequence there has been a welcome increase in interest shown by parents in apprenticeship as a career for their sons, and local education authorities have also co-operated in putting the training scheme into effect. Schemes have been developed to enable entrants to the industry to obtain a high standard of theoretical knowledge as well as practical training in yards and workshops. Scholarships are open to the best apprentices, and it is hoped that with the improved pay there will be less incentive for boys to go to initially higher-paid employment which offers them no training for a skilled trade on reaching adult age. Whilst the industry recruits its executive staff largely through apprentices, both the Merchant Navy and the various Classification Societies also rely upon this source of supply for their engineering officers and surveyors.

It is of the utmost importance to the shipping industry and the country that the highest standard of training be maintained. This will be helped if full employment is assured in the yards. One recollects the tragic loss of skilled men from the industry in the slump between the two World Wars when many emigrated, to the considerable advantage of other countries.

Increasing competition from shiprepairers on the Continent—particularly from Germany and Holland—raises serious issues. Most of the shipyards in these countries were badly damaged during the war and have to a considerable extent been rebuilt. Many new shops of modern design with the most up-to-date machine tools have been erected. Having as a rule plenty of room, the transport systems have been overhauled and arranged for speedy movement of men and materials throughout the yard. New docks have been built and others enlarged and modernised. First-class heavy duty cranes have been provided and all this has meant an enormous capital outlay which undoubtedly has been state-aided. American aid has also been used extensively in this connection. In France, new machine tools which have been accepted as reparations from Germany are installed in many yards.

The wages paid in Continental yards are—in general—less than those paid in the United Kingdom, and in addition there are less onerous terms for overtime and shift work. The men are anxious to retain employment and work well. One of the most important factors undoubtedly is the general acceptance of a system that enables the management to transfer men readily from one job to another. This greatly facilitates repair work and enables individual jobs to be efficiently manner and assists in the planning of continuous working. It cannot, unfortunately, be said that the same conditions exist in British yards. Here there is still a great deal of attention paid to demarcation between trades. This is to the detriment of the firms, and—I believe—also to the men themselves.

There is considerable unemployment in Germany, France and Italy, and this undoubtedly is reflected in the attitude of the men to this question of demarcation and also other problems. So anxious are they to retain their employment that strikes concerning demarcation very rarely occur. On the other hand, however, strikes do occur from time to time in Continental yards on political issues. We are happily spared this form of labour trouble.

Owing to the versatility of his labour and his ability to man overtime and shift work, the Continental shiprepairer is usually able to quote a reduced time to complete the work as compared with the shiprepairers in the United Kingdom. This saving in time does in fact reduce the overall cost of the job, but more important to the shipping company is that this reduced time in port enables him to increase the earning capacity of his vessel. Whilst such conditions prevail the British shiprepairer is going to find this competition most difficult to overcome.

It is not easy to see how any radical changes can be made in the shiprepair yards in this country. We must increase our drydock capacity for larger ships either by building new drydocks or enlarging existing ones. Our yards must be equipped with the most efficient machine tools, cranes and services to meet the new requirements. All this involves large capital outlay which must be borne by the shiprepairers themselves without the aid so lavishly given to their Continental competitors.

A high standard of living has been provided for people in this country by our leadership in world commerce, our merchant fleets having at all times been pioneers in opening up new markets for trade. Our Navy has kept us free from foreign invasion for close upon a thousand years. These two great services call for the highest state of efficiency in our shiprepairing yards and many members of this Institute who are serving the industry will, by their initiative and determination, see that we prove worthy of our great heritage.

Improvement Scheme at Hartlepools

Reconstruction of Deep Water Berth

As part of a £570,000 modernisation scheme planned by the British Transport Commission for Hartlepools Docks, work is in progress on the reconstruction of a deep water berth in reinforced concrete. The quay is to be lengthened from 400 to 570-ft., and widened to 86-ft. at the western end tapering to 76-ft. at the eastern end. Dredging will provide a depth of 29½-ft. L.W.O.S.T. Six railway lines are planned to run the full length of the berth, with five standage lines at the rear of the quay, additional siding

Work in progress on deep water berth at the Hartlepools.

accommodation and improved access for road transport vehicles.

Four 12½-ton electric level luffing cranes with a grabbing capacity of 10 tons are to be installed, and one 10-ton electric level luffing crane with a grabbing capacity of 7½ tons. Among other improvements to be made is the installation of floodlighting equipment to enable work to be carried on during hours of darkness.

The Improvement Scheme was started in July, 1953, and is expected to be completed by the Autumn of next year. It will particularly benefit the two most important trades at the port, those of timber and iron ore, by making possible the handling of larger ships at the berth.

Rehabilitation of the Port of Rangoon, Burma

Devastated Sheds and Jetties Rebuilt

By R. I. WARWICK, M.I.Struct.E.

RANGOON is a riverine port situated approximately 22 miles up the Rangoon River, and pre-war consisted of 10 deep water wharves, six of "Screwcrete" and reinforced concrete construction, and four of steel screw-pile construction, one 500-ft. x 45-ft. deep-water landing pontoon connected to screw-pile jetties at the foreshore by four 100-ft. span steel bridges, 36 pontoons of sizes varying between 300-ft. and 120-ft., all connected to jetties of various types of construction by standard 80-ft. span steel bridges; there were also nine single-storied steel framed transit sheds, and one two-storied steel framed transit shed with a total approximate floor area of 625,000 sq. ft.

The transit sheds were served by 1½ ton electrically or hydraulically operated wharf cranes and at Brooking Street Wharf a 40-ton heavy lift crane was installed

In addition, 50-ft. span single-storied steel framed godowns, sheeted and roofed with galvanised corrugated sheets, were located in various depots laid out to suit the pre-war pattern of commerce through the port. These godowns provided in all a total covered floor area of approximately 500,000 sq. ft. and were served by metre gauge railway sidings, connecting to the Burma Railways system, and by approximately 20 miles of roads within the port boundaries.

A modern marine workshop and chain testing house with three slipways capable of accommodating vessels up to 8-ft. draft and 120-ft. long was maintained for the servicing of the port flotilla of 17 vessels, consisting of dredgers, pilot vessels, buoy vessels, survey craft, etc., and for the maintenance of the river lights and pilotage beacons.

With the port facilities briefly described above, the average volume of sea-borne trade handled by the Port of Rangoon was a little over 5 million tons per year.

During the war the port area was subjected to bombing by the Japanese, followed by systematic destruction as a denial measure prior to evacuation by the Allies in 1942. It was regularly bombed by the Allies between 1942 and 1945, and then subjected to further denial destruction by the Japanese prior to the re-occupation of Rangoon by the Allies in 1945.

The result of this period of destruction was that practically every building in the port area was either totally destroyed or heavily damaged, and all the pontoon jetties had been destroyed or heavily damaged. With the exception of one dredger and a pilot vessel, the flotilla was lost; every crane was destroyed, with the exception of the 40-ton crane, which had one leg blown off and was hanging precariously over the edge of the wharf (it was subsequently recovered, repaired, and is now in use); and the river foreshore and the damaged wharves were badly obstructed by wrecks.

The immediate and formidable task of providing temporary facilities was undertaken by the Military Authorities in 1945 with the provision of port construction pontoon units, Bailey bridging equipment and the ubiquitous Nissen huts.

Of necessity the work carried out during this period was extemporary and actually tended to retard and make even more difficult the task of permanent rehabilitation undertaken later.

In early 1946, the administration of the port returned to the control of the Commissioners for the Port of Rangoon and a start was made on the work of clearing the most serious obstructions from the river (much of this work was carried out by an Australian salvage party); the clearance of debris from the wharf areas; first-aid repairs to the two transit sheds that were not wholly destroyed; the erection of Nissen huts from materials left behind by the Military Authorities; the assembly of temporary P.C. pontoon and Bailey bridges to replace the lost pontoons; and first-aid repairs

Sule Pagoda wharves 3 to 8 at re-occupation of Rangoon in 1945.

Sule Pagoda wharf transit shed No. 3 in 1949. Temporary Nissen huts at S.P.W. No. 4 in background.

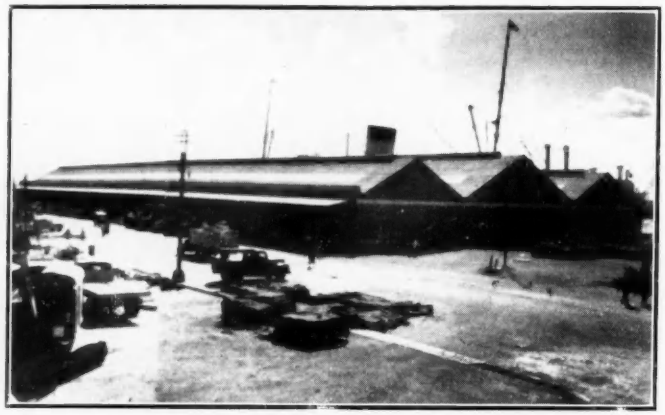
to the fixed jetties at the river foreshore. Repairs to road and rail facilities were also carried out.

This phase of temporary repair work proceeded until 1947 and was financed by Government loans on a month-to-month basis; no planned programme of rehabilitation was in existence at this time.

By the end of 1947 political events in the country, culminating in the independence of Burma, began to have a profound effect on the work of rehabilitation. At the commencement of 1948 there was only one qualified engineer left on the staff. The Government was no longer in a position to advance funds for capital works and the port finances were in such poor shape that such works as were essential to deal even with the greatly reduced volume of traffic at that time had to be financed from revenue.

During 1948, following repairs to the reinforced concrete wharves, a new transit shed of steel framed construction, 350-ft. long x 130-ft. was constructed, and a new extension measuring

Rehabilitation of the Port of Rangoon—continued



New transit shed 420-ft. x 150-ft. at S.P.W. No. 4 in June 1953.

160-ft. x 150-ft. was added to one of the damaged transit sheds, using salvaged materials only. Even the roller shutter doors were made up from the remnants of the doors originally in the destroyed sheds.

By the end of 1948 the port had repaired or erected four steel framed transit sheds providing 200,000 sq. ft. of floor area, and six deep water wharves had been cleared of obstruction and dredged. Twenty-eight P.C. pontoons, complete with repaired steel bridges and Bailey bridges, had been installed, and approximately 200,000 sq. ft. of Nissen huts were erected in temporary replacement of the lost godowns and transit sheds.

With the commencement of 1949 the new Government of Burma was facing even greater difficulties as a result of the insurrections, and in early 1949 work on reconstruction was virtually at a standstill. Labour had to be retrenched and it was only with great difficulty that a nucleus of skilled supervision and craftsmen could be retained.

By the end of 1949 a certain amount of economic recovery had been made and trade was flowing through the port at the rate of about 30% of the pre-war volume; this was beginning to tax the reduced port facilities and made even more urgent the task of increasing the pace of permanent rehabilitation.

Notwithstanding the apparent hopelessness of the financial situation, it was decided to draw up a phased five-year programme on paper, and the wisdom of this step became apparent when, in the early months of 1950, a number of missions made their appearance in Burma investigating the possibilities of giving economic aid to the country.

Towards the end of 1950, the Government of the Union of Burma formally agreed to accept assistance from the Economic Co-operation Administration of the U.S.A., and a sum of $10,000,000 was allotted for expenditure for Burma up to June, 1951. A Scientific, Technical and Economic Mission was established in Rangoon, and the Government of the Union of Burma established the Burma Economic Aid Committee to co-ordinate the requirements of those Authorities able to accept aid from E.C.A.

In the case of the Port of Rangoon, the detailed working out of these requirements was delegated to the author, in collaboration with the officers of the S.T.E.M., and after a period of intensive activity E.C.A. authorised the supply to the port of materials to enable the following projects to be carried through:

(1) The provision of materials for a deep water landing pontoon 500-ft. long and 40-ft. wide;
(2) The provision of materials for ten new steel pontoons, each 120-ft. x 20-ft.;
(3) The provision of structural steelwork, asbestos cement roofing, glazing, steel casements, glass and roller shutter doors for three transit sheds at Ahlone Depot to provide 90,000 sq. ft. of covered floor area;
(4) The provision of similar materials for erection on the site of the 340-ft. x 150-ft. destroyed shed at Brooking Street Wharf, and for the erection of a single-storied transit shed, 420-ft. x 150-ft., on the site of the destroyed double-storied transit shed at Sule Pagoda Wharf No. 4.

At the time these requirements were drawn up, it was not known from which source these materials could be obtained, and it was therefore not possible to prepare precise designs. Moreover such a proceeding would have been beyond the capacity of the port's small drawing office staff in the short time available.

It was decided therefore to prepare $\frac{1}{8}$-in. scale drawings and to write up specifications that could be utilised in whichever country procurement was found to be practicable.

Armed with this technical information and authorised by the E.C.A. Authorities to incur the necessary expenditure, a S.T.E.M. official proceeded on a flying visit to Hongkong, Washington and Tokyo, and discovered that the only country from which any early deliveries could be expected was Japan.

By making use of the Emergency Procurement Service, which was an emergency purchasing department set up in Tokyo under the American Occupation Authorities, invitations to submit designs and tenders were issued to a number of Japanese structural and shipbuilding firms, and in February, 1951, contracts were placed by the E.C.A. Authorities for the supply of materials for the deep water landing pontoon, the ten small steel pontoons, three transit sheds required for the reconstruction of Ahlone Depot, and for the new transit sheds at Brooking Street and Sule Pagoda Wharves.

The author immediately paid a flying visit to Tokyo for the purpose of ensuring that the supply of the materials contracted for by the E.C.A. authorities would meet the requirements of the port and that shipment could be related to the capacity of the civil engineering organisation in Rangoon to carry out the necessary site works, such as the preparation of foundations for the transit sheds, and the assembly and launching of the pontoons. The situation was a little delicate since all the materials were contracted for and were to be paid for by the American E.C.A. authorities. But the author found willingness on the part of the Procurement Authorities and the suppliers to adjust their quite understandable desire to dump the materials into Rangoon in the shortest possible time and to receive payment, in favour of a phased programme of delivery that would avoid site congestion. In the event a certain amount of dumping did occur, but it was only in connection with the pontoon materials and was not so difficult to manage as would have been the case had the transit shed materials been similarly unloaded in unmanagable quantities.

At the time of leaving Tokyo in March, 1951, work was in hand by the suppliers on the preparation of working drawings for:

New steel tank pontoon landing stage 500-ft. x 40-ft. installed at Port Health station in 1953.

Rehabilitation of the Port of Rangoon—continued

(1) One 500-ft. x 40-ft. deep water landing pontoon;
(2) Ten 120-ft. x 20-ft. steel pontoons;
(3) Three transit sheds for Ahlone Depot:—(a) one 300-ft. x 200-ft.; (b) one 200-ft. x 100-ft.; and (c) one 100-ft. x 50-ft.;
(4) One transit shed for Brooking Street Wharf, 340-ft. x 150-ft.;
(5) One transit shed for Sule Pagoda Wharf, 420-ft. x 150-ft.

The detailed drawings for items Nos. 1, 2 and 3 were received in Rangoon and returned duly approved during April, 1951, and by the end of October, 1951, all the materials had arrived in Rangoon, the only materials having to be provided locally being the timber decking and fenders for the pontoons, and cement, aggregate, sand and bricks for the foundations and superstructures of the transit sheds.

The detailed drawings for items Nos. 4 and 5 were received in Rangoon in August, 1951, and all the materials for these two transit sheds had arrived at the site by the end of November, 1951.

In the meantime work on the construction of piled foundations for the Ahlone Transit Sheds had been proceeded with, as had the work of preparing slipways for the assembly of the ten 120-ft. x 20-ft. steel pontoons and arrangements had been completed for the assembly and riveting of 35—40-ft. x 10-ft. x 5-ft. steel tanks, comprising the hull of the 500-ft. x 40-ft. deep water landing pontoon. The work of rooting out the damaged foundation bolts from the site of the destroyed transit sheds at Brooking Street Wharf and Sule Pagoda Wharf was also taken in hand and by adopting a series of unorthodox methods, extensions were made to these old foundation bolts to prepare them for the reception of the new steelwork.

In the design for the foundation for Ahlone Sheds special considerations applied. The area on which they were to be built was reclaimed land, and the commodity to be handled there was rice. The floor loads were calculated at 6 cwts. per square foot, and the presence of huge quantities of rice meant that a colony of rats would infest the area. Past experience of these pests showed that the effect of their underground burrowing had been responsible for collapsed floors and superstructure, and to get over these difficulties the foundations for the superstructure were designed to consist of 25-ft. long concrete piles driven at the stanchion bases and monolithically connected to R.C. plinth beams supporting the walls of the superstructure, the 6-in. R.C. floor being laid upon sand filling with no connection to the superstructure.

In addition to the constructional projects described, E.C.A. aid was forthcoming for the supply of further materials, and port equipment aimed at restoring the port's capacity to its pre-war level in accordance with the Five-Year Programme drawn up in 1949; and during the period March, 1952, to September, 1952, the following materials and equipment arrived in Rangoon following procurement action taken between September, 1951, and March, 1952.

(1) Materials for a further 5—200-ft. x 40-ft. steel tank pontoons;
(2) Two steel truss bridges 80-ft. span;
(3) One steel truss bridge 104-ft. span;
(4) Machine tools and equipment for workshops;
(5) Electrical sub-station equipment;
(6) Structural steelwork, asbestos cement roof sheets, steel casements and roller shutter doors for three open transit sheds totalling 22,500 sft.;
(7) Two sets of fixed river moorings comprising four river berths;
(8) Electrically operated cargo handling equipment;
(9) Five 5-ton mobile cranes;
(10) Two 3/4 c. yd. dragline excavators; and
(11) Civil Engineering Plant and Equipment.

The approximate total value of materials and equipment supplied between September, 1951, and September, 1952, was 2,300,000 U.S. dollars.

The erection of the first two transit sheds at Ahlone was completed by March, 1952, the ten 120-ft. x 20-ft. steel pontoons were assembled, launched and placed in position by the end of April, 1952, the large new transit shed at Brooking Street Wharf was completed in June, 1952, the 300-ft. x 200-ft. shed at Ahlone was completed in March, 1953, and the 420-ft. x 150-ft. transit shed at Sule Pagoda Wharf No. 4 was completed in June, 1953.

New transit shed 350-ft. x 150-ft. at Brooking St. Wharf, East in 1952.

The first of the 200-ft. x 40-ft. steel tank pontoons was placed in commission in April, 1953, replacing the old temporary P.C. Pontoons, the second 200-ft. x 40-ft. steel tank pontoon was placed in commission in June, 1953, the third in July, 1953, the fourth in December, 1953, and the large 500-ft. x 40-ft. deep water steel tank pontoon was placed in August, 1953; work on the remaining 200-ft. x 40-ft. steel tank pontoon is proceeding and it is anticipated that by the end of March, 1954, all the remaining buildings, plant, moorings and equipment provided under this most generous aid programme will be fully engaged in the working of the port. Had it not been for this unexpected outside help, little could have been done towards the rehabilitation of the Port of Rangoon on permanent lines during the past three years.

All the site work, comprising the preparation of reinforced concrete piled foundations for the transit sheds, the assembly and erection of approximately 2,000 tons of structural steelwork, with asbestos and glass roof sheeting, steel window casements and roller shutter doors; and the construction of the brick and concrete superstructure and floors, was carried out by locally engaged labour working directly under the supervision of the port's engineers and supervisory staff, as was also the work of assembly and launching the ten 120-ft. x 20-ft. steel pontoons, the assembly and launching of the 500-ft. x 40-ft. steel tank pontoon, and the 200-ft. x 40-ft. steel tank pontoons, including the construction and fixing of the necessary timber decking and fenders.

Much work still remains to be done and plans are under consideration for the construction of three new wharves and transit sheds, and the provision of additional mechanical handling equipment for the more expeditious handling of cargo in the port.

Acknowledgment is made to U. Win Pe, Chairman of the Board of Management for the Port of Rangoon, for his kind permission to publish the foregoing account of Rehabilitation activities, and to U. Khin Maung Gyi, Executive Engineer, for his valued assistance in preparing the illustrations.

Irrawaddy Shipyard Project.

According to reports from Tokyo, Japanese shipbuilding companies are drawing up plans for the construction of a small shipbuilding yard on the Irrawaddy River near Rangoon. The new yard is one of the projects planned under the reparations agreement reached between Burma and Japan last month. At least three Japanese shipbuilding firms have expressed interest in the scheme and are preparing their own plans for the yard. These envisage the building of 1,000-ton and 2,000-ton coastal vessels in the first year, and 10,000-ton ocean-going vessels after four years. As in Japan, the plans include an auxiliary steel plant for the manufacturing of girders and pipes when shipbuilding is slack.

Roofing for Transit Sheds and Industrial Buildings

A New Corrugated Aluminium Sheet

The choice of a suitable roofing material for industrial buildings has always been a subject for some discussion. It can hardly be disputed that durability comes first, but against this must be weighed the material's cost, for, as in so many other applications, low cost and really long-lasting qualities rarely combine in one material. The reconciliation of these two factors is a major problem for the designer, who must weigh initial expenditure against the probable costs of maintenance and replacement. Before the war labour and service costs were not inordinately high, and the use of comparatively cheap roofing materials was justified. To-day, however, labour costs have risen to such an extent—and show no signs of falling in the near future—that those concerned with planning new buildings or the re-roofing of old must look for a material which requires hardly any maintenance.

Durability alone is not enough, however, and there are other circumstances connected with the use of roofing and cladding sheets that require consideration when selecting a suitable form.

Comparison of the costs of the types of sheeting available must take into account firstly the initial cost of supply and erection; the additional expense or saving that may result from modification of supporting structural members; the durability or life of the material in unfavourable atmospheric conditions, and the physical properties of the material, i.e. its suitability for use in a given situation, and other considerations such as the magnitude of the particular proposal under review.

Considering the initial cost of supplying and fixing the usual types of corrugated sheeting, the cheapest is untreated mild steel but it is not much employed now except possibly for temporary buildings. Others in ascending order of cost are asbestos cement, galvanised mild steel (18 g.), proprietary coated mild steel (22 g.) and lastly aluminium alloy.

In the case of asbestos and the proprietary forms of coated mild steel sheeting the purlin spacing in roofs will require to be less than in the other types, and this will entail additional expense.

Corrugated asbestos cement is the least vulnerable to atmospheric conditions, and its low initial cost and immunity from corrosion make it a very economical proposition in many situations where its lack of physical strength is not of importance.

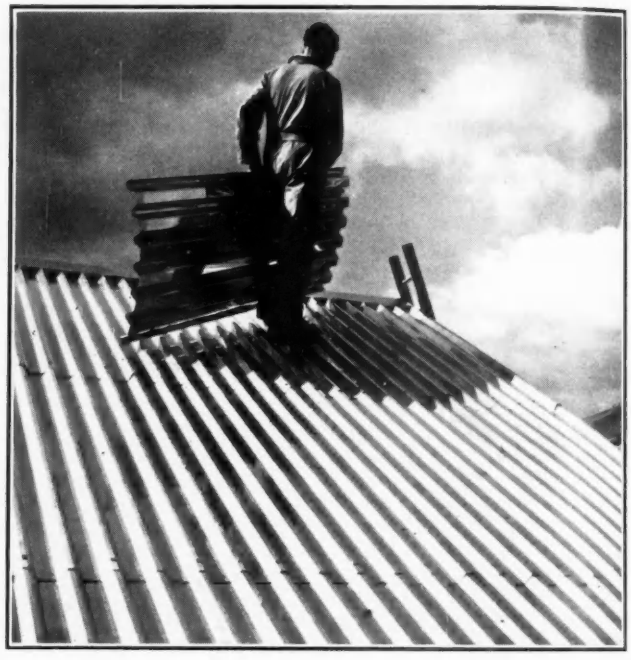
In dock undertakings, however, the side and end walls and roofs —particularly at the eaves—of transit sheds are in varying degrees liable to damage from quay and mobile cranes and from the use of fork-lift trucks inside the sheds. Unless it is protected, which of course adds to its cost, asbestos sheeting may not be the best medium to use as a covering for such buildings.

The material that is now becoming recognised as having all the necessary attributes of a successful cladding material is aluminium. No longer restricted in its uses by its high pre-war cost (relative to other materials) or by post-war scarcity, aluminium can provide a sound answer to the problem of industrial roofing. It has weathering characteristics of a very high order, and in addition combines strength and lightness to an extent that makes it an ideal roofing material in most situations.

Of the whole range of aluminium-based alloys, the pure metal itself has the highest resistance to corrosion (except in exclusively marine applications); it is of course well known that this resistance is due to the very thin, adherent and self-healing film of oxide that rapidly forms on the metal when exposed to the air. Pure aluminium, however, is comparatively soft, and before it can be used as a practical sheeting material it must be alloyed with another metal to provide strength. If 1¼% of manganese is added, the result is an alloy that still retains its high resistance to corrosion, and at the same possesses mechanical properties (an Ultimate Tensile Stress of 12-14 tons/sq. in.) that make it excellent for use in sheet form for roofing. This particular alloy, Noral 3S, conforms to BSS.1470 NS3, and its universal use as a roofing and siding material makes a comparison of its weathering properties with those of other materials of great interest.

A very comprehensive investigation of the corrosion resistance of aluminium alloys and other metals has been carried out in America during the last twenty years. In this investigation test pieces were exposed to typical rural, marine and industrial atmospheres, and measurements taken of the degree and rate of corrosion; from the results obtained it has been possible to predict the behaviour and length of life of a variety of metals in various situations.

Results show that Noral 3S sheet 0.036-in. thick, on which corrosion advances by the formation of surface pits, could be expected (allowing a factor of safety of two) to last more than 50 years in severe marine or industrial environments, and over 100 years in tropical or rural situations. This "life" is the length of time (approximate, since conditions vary greatly in different localities) that will elapse before pitting becomes so deep as to bring about complete penetration. Comparative figures for galvanised steel sheet (quoted by the British Standards Institution) show that sheet 0.036-in. thick, and with a zinc coating of 0.75 oz./sq. ft. on each surface, will last 5½ years in industrial, 10 years in urban, 16 years in coastal and 25 years in rural environments. No allowance is made for a safety factor in these figures.



Noral "Industrial" roofing sheet on a typical installation. The narrow crests of the corrugations resist denting by the boots of maintenance parties.

Whereas it is not surprising that aluminium shows greater resistance to attack than galvanised steel, the results of comparison with other metals are rather more unexpected. These show that 3S aluminium sheet corrodes very much more slowly than copper and zinc in rural and some marine situations, and rather more slowly in industrial surroundings; figures for two industrial locations give the following corrosion rates (depth of pitting in thousandths of an inch per year):—

New York:	copper 0.047	zinc 0.190	aluminium 0.031
Altoona Pa:	copper 0.046	zinc 0.190	aluminium 0.025

These figures are taken from reports of the investigations carried out by the American Society for Testing Materials.

An important feature of the nature of the corrosion of aluminium is that attack is self-stifling; a rate of attack that may be quite high when the metal is new will slow down within a year or two to a very low figure as the coating of oxide builds up. Moreover, since this resistance is an inherent feature of the metal itself, a scratch or other break-down of the original surface cannot lead to a rapid attack on the body of the metal.

Coupling these facts with knowledge of the behaviour of light alloy sheets in specific industrial installations shows that from the point of view of durability the 1¼ per cent. manganese aluminium alloy is completely suitable for use as a cladding material.

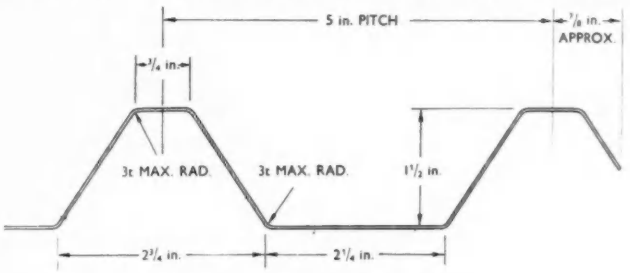
Roofing for Transit Sheds and Industrial Buildings—continued

and it has, of course, the virtues common to the other forms of corrugated sheeting, of being non-combustible, not contributing to the spread of fire, and being completely resistant to the attacks of fungi, insects or vermin.

Although capable of resisting atmospheric corrosion, aluminium alloy has other corrosion problems which, however, are not insuperable. For example, it must not be allowed to be in close contact with ferrous metals, otherwise it will become the anode, and be sacrificed, in an electro-chemical reaction which is bound to ensure. Also care must be taken with the positioning and earthing of electric cables.

In 1951 a transit shed, roofed with corrugated aluminium alloy sheeting, was built by the Port of London Authority at Tilbury Docks, Essex, where atmospheric conditions are particularly injurious to galvanised sheeting. The shed is 300-ft. long by 120-ft. wide, with the trusses at 15-ft. centres and the aluminium alloy purlins at 7-ft. 6-in. centres. All cleats, hook bolts, rivets, etc., ridging, glazing bars, gutters and down-pipes are of aluminium alloy. The gauge of the sheeting is No. 18 with six 5-in. corrugations and is to B.S. No. 1470, aluminium-manganese alloy No. N.S.3, tempered three-quarters hard.

Overlaps and contact points with steel trusses were coated with zinc-chromate paint and gutter joints were made with ordinary putty and string. Wood anti-condensation blocks were fitted, in



Section of corrugated sheeting.

accordance with the standard practice of the docks, between purlins and sheeting.

The cost of this aluminium roof was £11,350 as against £2,800 for a similar roof carried out in steel which has a normal life at Tilbury of only 10 years and requires repainting every three years at a cost of £600. If, therefore, the new roof lasts 50 years, in accordance with the test results quoted above, it appears that the use of aluminium alloy roof sheeting will be a most economical proposition.

Although the metal itself can be regarded as being suitable, much of its value may be lost unless it is applied in a form that takes advantage of its characteristics. Corrugated sheets form a comparatively inexpensive yet effective roofing for many types of industrial buildings. If, however, aluminium is substituted for steel in sheets of the existing forms, the qualities of the light metal are not made the most of; an aluminium roofing sheet specifically designed for the industrial building seems to be needed.

The main requirements of such a roofing sheet are that it should be sufficiently rigid to span at least 7-ft. 6-in., for use over the widely-spaced purlins of industrial buildings, and to allow for variations in structure design, and to be of a form that will allow maintenance men to walk on it without fear of local damage to the sheet. To ensure that these conditions are fulfilled with the maximum economy in material is a problem that can be decided only by practical testing. Experimental work, carried out by Aluminium Laboratories Limited and by the Aluminium Development Association, shows that the limiting criterion is to produce a sheet strong enough to withstand the concentrated weight of a man without local buckling of the corrugation.

The profile finally found to be the most suitable, and one that fulfils all requirements, is an asymmetrical section with deep straight-sided corrugations at 5-in. pitch; troughs are wide for rapid water-shedding, and the narrow crests are designed to resist denting by the boots of maintenance parties. This new "Industrial" sheet has a standard thickness for roofing purposes of 20 SWG, and can withstand without damage the concentrated load of 200 lb. on a 5-in. square specified by BS.CP3 (Chapter V); since the long span possible with this sheet (up to 9-ft.) reduces the number of purlins and attachments required, the cost and weight of a roof may often be less than it would be if one of the less structurally efficient roofing materials were used. Thinner sheet (22 SWG) can be used for siding in the interests of economy. The asymmetrical profile has been found to be quite pleasing to the eye, particularly for walls, and imparts to the building clean lines unobtainable with any of the symmerical profiles. This appearance, coupled with the pleasant grey colour to which the metal weathers, may well be a potent factor in establishing this new material, which is now coming on to the market in quantity, as first choice for the roofing and siding of many industrial and other buildings.

British Transport Report for 1953

Dock Undertakings again show Profit

The report and accounts of the British Transport Commission for last year reveal that for the third successive year the commission made a net surplus. It amounted to £4.2 mn., compared with £4.5 mn. in 1952, after meeting capital charges and interest payments amounting to £51.8 mn. There was a fall of almost £1,000,000 in the net surplus for ships.

The working surplus of all the commission's activities last year was £59.4 mn., made up of receipts of £48.2 mn. from carrying activities, £5.1 mn. from other principal activities such as docks and inland waterways, catering and leases, and £1 mn. from miscellaneous services and receipts. The total was some £3.7 mn. higher than in the previous year.

The report points out that 1953 was a year during which the commission's undertaking underwent radical changes, the full effect and significance of which cannot yet be properly assessed. Consequently it is suggested that the report should be regarded in a sense as an interim survey, and it is shorter than in previous years.

The abolition of all executives, save one, was carried through without serious dislocation of services, and the great constitutional changes brought about by the Transport Act, 1953, radically altered the duties with which the commission was charged.

In fact, the effects of the Parliamentary mandate for disposal of the road haulage undertakings did not exercise a disrupting effect, and the executive in its last year produced traffic receipts which were the best it had shown. Instead of being charged with "the duty of providing an efficient, adequate, economical and properly integrated system of public inland transport and port facilities within Great Britain," as laid down in the 1947 Act, the commission is now required to provide only "railway services for Great Britain and a co-ordinated system of passenger transport in the London area, together with certain other services and facilities."

The projects in hand last year for shipping services included the construction of seven Clyde passenger vessels, and four new cargo ships, of which two are refrigerated. Dock sheds at Southampton, deep-water berths at Hartlepools and new cranage in the ports of Swansea and Hull were also in hand or under consideration. Gross receipts from ships totalled more than £12.2 mn., of which some £5.4 mn. was derived from passenger traffic, £4.1 mn. from merchandise and £1.7 mn. from mail and parcels. Working expenses absorbed £11.2 mn., leaving net receipts of £950,000.

Freight receipts in the docks, harbours and wharves owned by the commission amounted to £17.5 mn., and after deducting expenses on working totalling £8.2 mn. and maintenance charges, a net amount of £2,446,000 was realised.

The fleet owned at the end of the year comprised 120 vessels of 66,756 net tons, employed almost equally on Continental, Channel Islands, Irish and coastal services. Altogether 136 ships, with a net tonnage of 79,233 tons were employed by the commission during the year. Expenditure amounting to approximately £2 mn. was authorised on further new works and equipment including hopper barges for dredging work at the Humber ports and Garston, transit sheds and quay cranes at Middlesborough and the extension of Margam Wharf at Port Talbot.

The London Docks' Strike

Report of Committee of Enquiry

The final report of the Court of Inquiry into the London docks dispute was published as a White Paper early this month (Cmd. 9310. Price 9d.). The Court reported that once it is conceded that overtime working in some degree is essential, the phrase "overtime should be in principle voluntary" can only mean that it should be regulated by mutual agreement between employers and workmen.

The principal issue arose out of the language of clause 8 (5) of the Dock Workers (Regulations of Employment) Scheme, 1947, which requires that a registered dockworker shall "work for such periods as are reasonable in his particular case." The court recognised that the view that overtime in the docks should be regarded as "voluntary" is held sincerely and strongly by large numbers of men as well as by their unions, but point out that no attempt was made to press the matter to a conclusion before January last—6½ years after the Scheme came into operation.

Moreover, the report makes it plain that few cases of disciplinary action arise in practice. According to figures supplied by the London Dock Board only in 115 cases were penalties imposed. Since the number of registered dock workers in the Port of London at the end of this period was 19.067 (including lightermen), it will be seen how very small indeed was the proportion of men actually "disciplined."

The Overtime Controversy.

Examining the overtime issue the report states that on the employers' side it is said that the effect of Clause 8 (5) (b) of the Dock Scheme is that the individual man is, in the last resort, under an obligation to work overtime, if the circumstances fairly so require, e.g. for the purposes of finishing ship. He may be able to supply a substitute for himself; the gang may be able and willing to work with short numbers; he may have personal or domestic reasons which fairly justify a refusal on his part; but in the absence of one or other of these considerations—and the Dock Labour Boards are the judges of such matters with a right of appeal—the man is bound by the Scheme to work. It is the presence of that sanction which (say the employers) accounts in large measure for the rarity of the cases reported. The employers say finally that an obligation of this kind is not the same thing as "compulsory" overtime, and they point to the fact that all men entering the industry do so freely and upon the terms that this "obligation" is, with the corresponding benefits of the Scheme, one of the necessary incidents of the occupation.

"On the other side," the report continues, "it is said by the N.A.S.D. that if and so far as overtime working is obligatory it is necessary to that extent 'compulsory' and that 'compulsory' overtime even in the restricted sense mentioned above is wrong in principle. They say further that it is wrong in principle that any outside body (e.g. the Dock Labour Board or its representatives) should have to investigate the private and domestic circumstances of a man, relied upon by him as excusing his working overtime. They claim finally that if all overtime was purely voluntary there would in fact be no shortage of volunteer workers.

"So far, there is beyond doubt a real issue of principle. The word 'compulsory' in an ordinary context indicates something that a man has to do, come what may (e.g. if a motor driver, to have a proper policy of insurance), whereas in the Dock Scheme the man's obligation is limited to working overtime if it is reasonable in his case for him to do so; still there does exist an obligation (and in that sense an element of 'compulsion') under the Scheme as it now stands.

"The practical significance of the point may however be a wholly different matter and we have it very much in mind that, from a practical point of view, the issue is one readily capable of adjustment. Furthermore, the issue is substantially narrowed in any case by the admission of Mr. R. Barrett (N.A.S.D.) that some overtime working is essential and that to that end some measure of direction is required.

"Thus Mr. Barrett, while adhering to the proposition that 'overtime should be in principle voluntary,' gives practical interpretation to the proposition by saying that it should be 'by mutual arrangement.' So narrowed, the issue may, we think, come down in the last resort to the question, whence will come the necessary direction?" The Court describe the issue as one which according to the general view (as the court repeat) is readily capable of settlement—a view supported by the facts (a) that Saturday afternoon and Sunday working is now in fact by mutual consent voluntary and (b) that an agreement was reached on the Port of London Authority Group Joint Committee in January of this year.

Conclusions.

The following is a summary of the conclusions:—

(i) In our judgment the word "periods" in Clause 8 (5) (b) of the Scheme must include overtime as understood in the Dock Industry. We agree therefore with the interpretation put upon the word by the P.L.E.C. in 1948.

(ii) It therefore follows that Clause 8 (5) (b) of the Scheme imports an obligation as to overtime upon the individual workman.

(iii) The obligation is, however, of a very restricted character—for it is an obligation upon the individual to work overtime only if and to the extent that it is reasonable for him to do so in all the circumstances of his case. Since some degree of overtime working is admittedly a necessary characteristic of the industry, the obligation may be said not to amount to more than an obligation to act "reasonably" as a dock worker as regards overtime.

(iv) Although, therefore, the statutory obligation involves "compulsion" to the limited extent above stated, we think that to describe overtime working under the Scheme as "compulsory" (as that word is ordinarily understood) is or may well be misleading.

(v) Further, since admittedly some overtime working is essential and some direction requisite, "voluntary overtime" is equally inapposite if the word "voluntary" is to have its ordinary significance of "at the free will of" the person concerned.

(vi) Although, therefore, the issue may fairly be said to involve a question of principle, i.e. whether overtime working should remain governed simply by the existing terms of Clause 8 (5) (b), or should be made (wholly or partially) the subject of "mutual arrangement," for practical purposes the issue is a narrow one which, in our judgment, is or should be capable of satisfactory resolution under the existing machinery without difficulty.

(vii) To that end we suggest that the paragraph in the Scheme might be amended or treated as amended by the addition of words at its end to the effect "but subject to any agreement come to with the appropriate joint industrial organisation."

(viii) The issue, though narrow and capable of solution as we have suggested, should nevertheless be regarded as a real one, at least to those in the industry, and one upon which many men entertain strong and sincere feelings; a proposition made sufficiently plain by the recorded discussions upon it in the Minutes, which we have quoted, over the past seven years.

(ix) We think moreover that the terms of para. 38 if Sir John Cameron's Report (which we assume to have been reflected in the form which Clause 8 (5) (b) ultimately took) indicates that the question of overtime working was not intended to rest permanently on the formula contained in the paragraph, without more.

(x) The word "reasonable," though hallowed in English law, is (according to that law) incapable of precise definition. If, then, the problem comes down in the end to the question, whence should the final sanction come, it seems to us both highly desirable and possible as a first stage to cover, by appropriate mutual arrangement on the lines, e.g. of that reached by the P.L.A.G.J.C. (see Part A of the Schedule), all matters capable of being so covered. In that event the unresolved residue would in any event be very small.

(xi) In the events which happened, and in our interpretation of Clause 8 (5) (b) of the Scheme, we feel no doubt that the imposition by the N.A.S.D. of the ban upon or stoppage of all overtime working was a breach of the N.J.C. Con-

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The Port of Seville

New Ship Canal Project

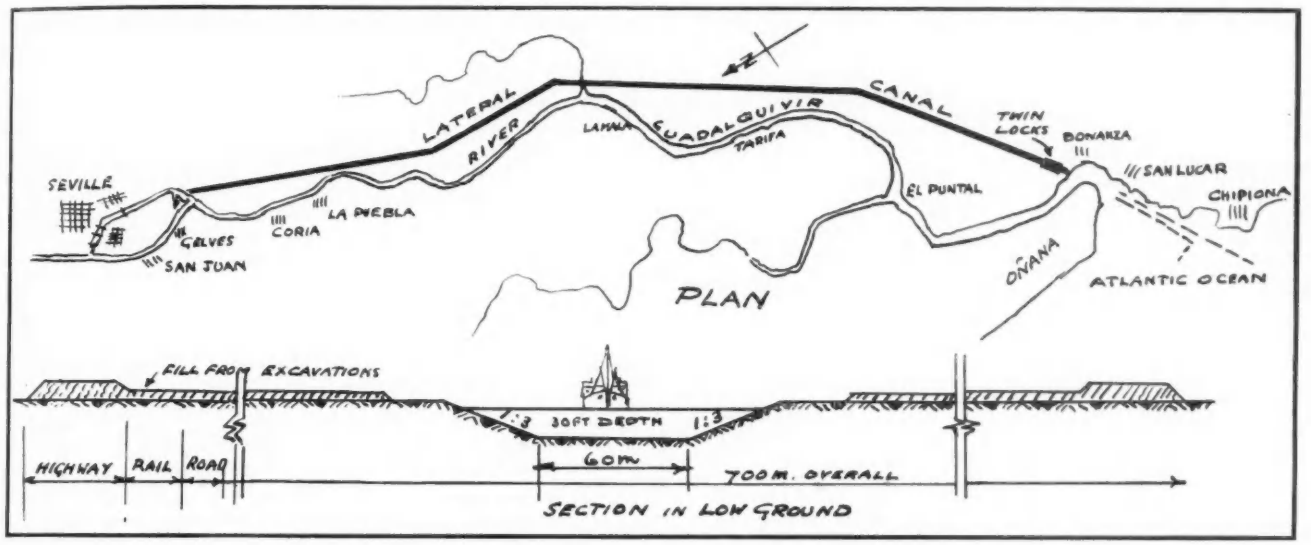
Seville, besides being the fourth largest city of Spain and one with a romantic historical past, has the distinction of being the only interior port of the country. It is connected with the sea by the River Guadalquivir and is 51 miles from Bonanza, at the throat of the estuary, where it debouches into the Atlantic between the better known Spanish seaports of Cadiz and Huelva. The distance of Seville from the coast by road is 75 miles and by rail 80 miles.

In recent years there has been a marked resurgence of democratic opinion throughout the country and an eagerness to participate in the community of nations, combined with a strong desire to resume international trading relations with the world. The call for industrial development and the full use of its many mineral resources and potential agricultural expansion has already taken shape in the construction of a number of hydro-electric power plants and irrigation schemes, particularly in the provinces of fertile and mineral rich land, of which Seville is the natural centre.

The actual traffic of the port is 1,200,000 tons annually even with the river in a more or less natural state. In view of the projects of development in the immediate zones of influence, including the provinces of Seville, Cordoba, Badajiz and Caceres, and also extensive portions of Jaen, Salamanca, Toledo and Cindad Real, comprising an area of 80,000 square kilometres, the prospects are a rapid increase of traffic to treble this capacity.

To deal with this demand the chief of State, during his visit to Seville in the spring of this year, ordered an immediate investigation into the most suitable scheme of developing the waterway to the coast. This was entrusted to Dr. Jose Buiza, the Engineer Director of Obras de la ria del Guadalquiver y Puerta de Sevilla, who presented after close study the preliminary proposal which was approved by Congress in June this year.

After consideration of three possible ways of achieving and maintaining a channel of 30 feet depth between the sea and Seville providing safe navigation for ocean going vessels, he eventually decided that a lateral canal would not only be the most economical but the most beneficial to the surrounding country. The surveys of the area showed the most suitable siting to be as shown in the figure. The cross section of the proposed canal shown is that for the low lying areas, where the spoil of the excavations is distributed to the flanks and provides a ground level which can be safely utilised for rail tracks and roadways and, where necessary, industrial or commercial installations. There will be only one twin lock at the sea end entrance near Bonanza.



R. R. M.

The London Docks' Strike—continued

stitution and machinery by which the N.A.S.D. was bound and also involved a repudiation and inevitable infringement by its members of the terms of Clause 8 (5) (b) of the Dock Scheme; and we think that the Employers were justified in so regarding it.

(xii) We equally feel no doubt that in withdrawing the labour of its members in the way it did on the 4th October the N.A.S.D. were further in breach of the Conciliation Machinery and the N.J.C. Constitution.

(xiii) We refer to the final paragraph of our Interim Report and venture to repeat our doubt whether many of those who sincerely and strongly feel that Clause 8 (5) (b) of the Scheme imposes an unfair burden, have reflected upon the seriousness of acting in disregard of the Conciliation Machinery, and in breach of the Dock Scheme. We wonder also whether they have sufficiently reflected upon the benefits of upholding the Dock Scheme as a whole; upon the very limited nature if the overtime obligation even as the Scheme now stands; and upon the circumstances that the advantage, achieved by maintaining a proper balance of labour force, of avoiding excessive stand-by time in normal hours necessarily involves liability for some appreciable overtime working.

New U.S.A. Standards for Fire Protection of Piers.

A revised edition of standards for the construction and protection of piers and wharves has recently been published by the National Board of Fire Underwriters in New York. They are expected to have widespread influence as a guide to good practices in dealing with the fire problems of this class of property which, for many years, has sustained an average loss per fire greater than that in any other class.

Prepared by a committee comprising representatives from port authorities, railways, and other users of water terminal facilities, fire chiefs, underwriters, the U.S. Navy, and others, these new standards focus particular attention upon the danger of fire underneath the main deck of piers and wharves with combustible substructures. These areas, which consist entirely of timber piling and cross bracing are very difficult to reach by fire departments. Where they are not sub-divided by fire-resisting bulkheads and lack automatic protection, they have been the cause of disastrous pier fires for many years past.

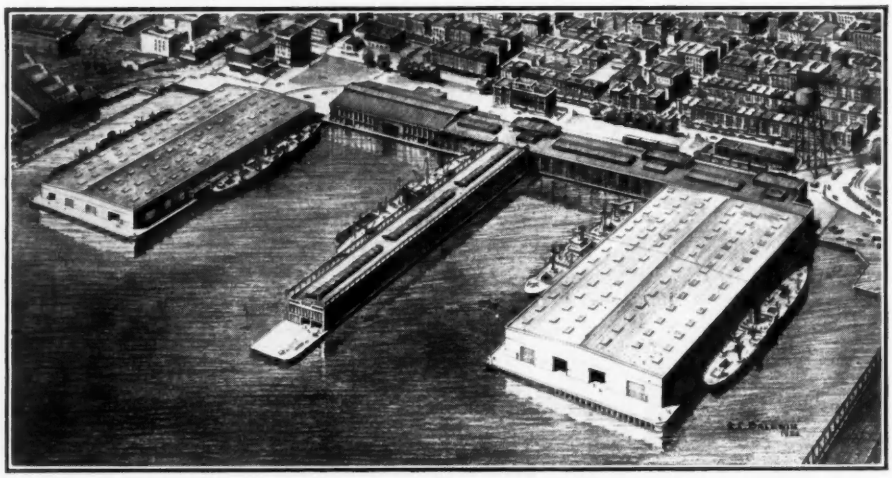
The new standards recommend completely non-combustible construction and specify that where wooden substructures are used the area should be suitably sub-divided to prevent the spread of fire, and that where the areas are greater than a specified minimum, automatic sprinkler protection should be provided. Methods of protection, superstructures and combustible cargoes, water supplies for fire-fighting, and other details are likewise covered.

New Piers at the Port of New York

Modern Marine Terminal at Hoboken

One of the largest marine terminal transactions in the history of the Port of New York was concluded recently when the American Export Lines Inc. signed a fifteen year lease for facilities on the Hudson River at Hoboken, New Jersey. The Port of New York Authority is to construct a new terminal which will cost $15,000,000.

The Hoboken Marine Terminal consisted originally of six piers extending along the water-front from Newark Street, North, to Fourth Street, but Pier No. 4 was destroyed by fire in 1921 and Pier No. 5 met with a similar fate in 1944. It is on the site of these two piers that the Port of New York Authority are to build the new terminal.



Artist's conception of the Hoboken Pier Development showing Pier A (at right), Pier 3 (centre) to be known as Pier B, and Pier C (at left).

Part of the scheme, to be known as Pier C, has been under construction since September, 1953, and is expected to be completed by March, 1955. Pier A will replace the existing Piers No. 1 and 2. Between Pier C and Pier A, Pier No. 3 will be modernised to accommodate passenger traffic and will be re-named Pier B. The completion of Piers A and C and the re-habilitation of Pier B will fulfil the Port Authority's obligations under the fifty year lease, signed in 1952, by the Port of New York Authority, the City of Hoboken, and the United States Maritime Administration, several years ahead of the originally scheduled completion date. By this agreement the whole terminal is leased by the Government to the City of Hoboken who, in turn, sub-let it to the Port Authority.

An old headhouse structure on the water-front is being retained with some small modification. The new Pier C projects from the water-front close to the headhouse and has a length of 700-ft. and a width of 328-ft. Supported on the pier decking is a transit shed 683-ft. long and 286-ft. wide—the widest in the Port of New York. The transit shed has a storage capacity of 192,440 sq. ft. and has 20-ft. headroom. Two railway tracks run along the centre of the shed between loading platforms while a third track is being constructed along the northern quayside to provide facilities for loading wagons direct from the ship.

Owing to previous losses in the type of structure the whole of the construction has been made fire-proof. No timber will be used in any part of the project other than the fendering which will be of greenheart piles driven at 7-ft. centres.

The decking of the pier is pre-stressed concrete supported on H piles and consists of post-tensioned concrete members connecting the pile heads, and pre-tensioned deck units. The post-tensioned members run laterally across the pier and are spaced at 21-ft. 6-in. intervals. Between these pile-head units the precast deck units run in a longitudinal direction. The pile-head bents were cast on the site and post-tensioned after the deck slab units were in place and grouted into position. The deck units were cast in the contractor's yard with 5/16-in. diameter cables tensioned before the concrete was cast. The units were cast in continuous moulds so that a length of cable was continuous through a number of slabs. The transit shed is built of structural steel units and steel covering. The water-front end of the shed has masonry facing to preserve the amenities of the district. Within the transit shed are the usual dock offices.

The construction of the pier necessitated dredging the river bed to give a depth of water of 30-ft. at low tide, and allowance has been made in the piling of the pier for an ultimate dredged depth of 35-ft. Borings taken over the site found serpentine rock at 140-ft. at the off-shore end of the site and at 90-ft. at the water-front. Above the rock lay a deposit of thick mud. It was consequently decided to use steel piles driven on to the rock, giving a bearing capacity of 90 tons.

Work on Pier A, which will be similar to Pier C, is shortly to be put in hand and is expected to be complete by the end of 1956.

The existing Pier 3, which is to be re-named Pier B, will be modernised to include first-class passenger accommodation on the upper deck. Modern cargo facilities will be provided on the lower deck of the 91-ft. wide by 949-ft. long pier. The modernisation will include the installation of a sprinkler system and the provision of the latest fire preventive devices as well as the concrete capping of pier piling and the re-habilitation of the mechanical, electrical, and water systems.

The American Export Lines will transfer to Hoboken by the end of 1956 all operations with the exception of the luxury liners now using Pier No. 84, North River, and certain cargo operations at Pier No. 39, Brooklyn. It will use the Hoboken facilities for its four "Ace" passenger-cargo liners and for the twenty-five cargo vessels operating to European, Mediterranean, Indian, Middle and Near East ports. These twenty-four vessels make approximately 150 foreign voyages, transporting about 800,000 tons of cargo in and out of the Port of New York annually.

Manufacturers' Announcements

Modified Diesel Shunter

E. Boydell & Co., Ltd., Manchester, manufacturers of Muir-Hill dumpers, loaders and shunters, have specially modified a diesel-powered shunter for use in such localities as refineries, oil docks, etc. The use of prime movers of normal type in such localities involves a certain amount of risk owing to the inevitability of there being pockets of petroleum vapour in the general atmosphere. The conditions prevailing at some docks are such that no vehicles entering the premises are allowed to move under their own power, and the provision of a specially modified towing unit is therefore essential.

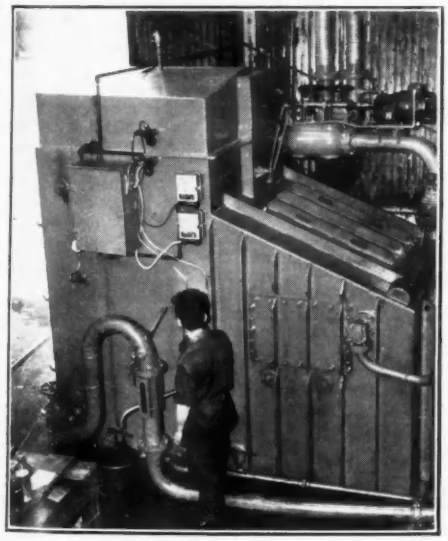
The modified Muir-Hill shunter is provided with a special frame and buffer plates with low multi-jaw couplings to facilitate the easy towing of a large variety of commercial vehicles, cars and trailers. The exhaust gases are passed through a water-filled quencher mounted in the near side ballast box thus eliminating the risk of live sparks from the exhaust. Compressed air starting is employed, this being a self-contained spark-free system comprising a compressor and receiver and air motor mounted in place of the normal starter motor. Working lights are operated by a slave battery which is totally enclosed, and all wiring embodies double pole circuits. The machine weighs 8500 lb. in working order and has a maximum drawbar pull of 6000 lb. In handling railway wagons the rated capacity is quoted at 400,000 lb. on straight level rail.

Manufacturers' Announcements—continued

Oily Water Separator

Messrs. White's Marine Engineering Co. Ltd., of Hebburn-on-Tyne, have produced an oily water separator which is claimed to be suitable for dock and harbour uses. The "White" Oily Water Separator is the outcome of years of experiment and is designed to meet the requirements of the "Oil in Navigable Waters Act." The oil and water mixture to be separated is pumped direct through an inlet valve into the primary separator chamber which separates 90 per cent.—95 per cent. of the mixture, the oil rising and collecting in the upper section. The remaining mixture then passes into a secondary chamber where further separation takes place before the balance enters a tertiary chamber containing a filter bed.

The apparatus has an electronic method of control and is completely independent of the specific gravities of the liquids involved, and therefore no adjustments are necessary on change of specific gravity. For this type of control the electrostatic properties of the liquids are utilised. This is achieved by inserting two insulated metal probes in the oil chamber at the desired upper and lower water levels, and applying a voltage of radio frequency to each. Each probe, the liquid surrounding it, and the tank of the separator, acts as an electrical condenser. Because of the fact that different liquids have different di-electric properties, the capacitance of this condenser changes with the change of liquid surrounding the probe. The change of capacitance causes a relay to operate, which in turn operates the contactor controlling the discharge valves, e.g. when the oil level reaches the lower probe,



the relay operates and the oil discharge valve is opened, thus discharging oil from the separator until such time as the water level reaches the upper probe; when this occurs another relay operates and opens the water discharge valve, thus discharging water from separator until the oil level again reaches the lower probe. The oil and water discharge valves are electrically and mechanically interlocked to prevent both oil and water being discharged from the separator at any one time.

Because of the low voltages and powers applied to the probes, there is absolutely no danger of spark or fire hazard to the oil in the separator.

Tests carried out in July last included one on a mixture containing approximately 75 per cent. of oil, and the resultant separated water showed only 22 parts of oil per million parts as against the 25 parts per million parts as laid down by the Ministry of Transport as a standard of cleanliness.

Long Range Signalling Lamp

For the past 38 years, the excellence of the design of the Aldis signalling lamp has been proved by the fact that it has remained unchanged, except for minor alterations, since it was first introduced. A new long-range lamp, which has five times the light output of its predecessor has now been marketed.

The bulb is burned at full brilliance the whole time, the signals being made by means of a tubular shutter which completely chops off the light of the lamp, and prevents it from reaching the reflecting mirror. When a signal flash is being made, this shutter is withdrawn from the hole in the centre of the

mirror, and the entire mirror gives a full flash. In this way crisp, clear signals can be made at over three dots per second, which is the equivalent of twelve words per minute.

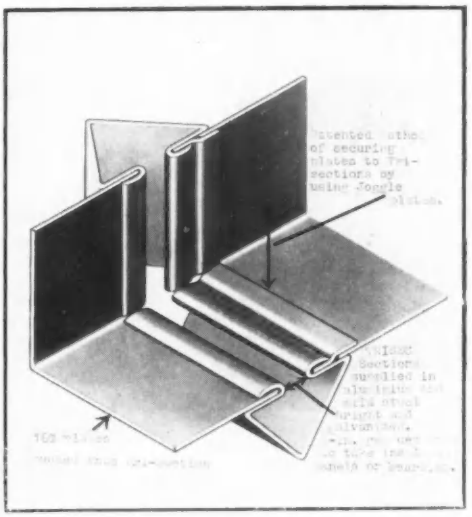
To reduce the strength of the beam at close quarters and to provide secrecy at night, the Aldis Secret Device is incorporated which effectively reduces the beam candle power to between eight and fifteen; red and green filters are also provided. The built-in telescopic sight of approximately two-times magnification enables the operator to pick up a small target and assists in reading signals flashed at extreme ranges.

If service is necessary adjustments can be carried out without the use of any special equipment. By using an appropriate resistance or transformer, the new lamp may be run on any of the normal ship's main voltages, either A.C. or D.C., and the body is earthed. The Ministry of Transport Specification requires ships to carry a boxed secondary battery from which the lamp may be powered. The Aldis battery has a working life more than half as long again as the M.O.T. requirement.

The Longrange signalling lamp is made by Aldis Brothers Ltd., of Birmingham, and is marketed and serviced in the U.K. by Kelvin & Hughes (Marine) Ltd., of London.

Sections for Structural Work

A new construction medium in the form of a cold rolled section has recently been introduced by Imex Engineering Ltd., Glasgow. It has applications in shipbuilding, structural engineering, refrigeration and insulation work, and has already been employed in these fields.



Known as "Trisec," the section is of triangular shape with a $\frac{7}{8}$-in. opening on one side, and two folded edges formed from this opening. These enable 16 gauge sheets to be directly fitted, or, alternatively by using a joggle plate, various thicknesses of plate can be accommodated. The sheets are all secured without the use of nuts, bolts screws or welding. The $\frac{7}{8}$-in. opening has been designed chiefly to hold boarding, but there are various types of fittings made for the securing of pipes, conduit, cables, etc.

The main applications for Trisec have so far been restricted to the insulation and refrigeration fields, but there are obvious uses in the metal fabrication industries. Complicated structures can be erected and dismantled simply, speedily and without the fixing normally considered necessary.

Designs incorporating Trisec have been used in the manufacture of insulated cabinets, and rooms for housing specialised machine tools, precision gauges, and electronic equipment.

The triangular shape enables a combination of four sections to be made, forming a pillar to divide space into any number of sections, particularly aboard ship, in insulated space or in portable structures.

Trisec can be fitted to channels to form partitions and bulkheads; or, where timber structures are involved, special triangular wooden blocks are inserted into the hollow of the Trisec to provide plugs for screws, etc. Sections are supplied in 16 gauge mild or galvanised steel, and aluminium, in random lengths, or to cut sizes up to 20-ft.

SITUATIONS VACANT

NIGERIAN PORTS AUTHORITY
VACANCIES FOR SENIOR EXECUTIVES

The NIGERIAN PORTS AUTHORITY has vacancies for the following Senior Staff. The Authority was recently created as a Public Corporation and offers good prospects.

PORT MANAGERS (M3B/34696/DU) for Lagos and Port Harcourt. Salary commencing at £2,000, according to qualifications and experience. Applicants must have a thorough knowledge of all aspects of port operating and have had practical experience in the management of a modern port and the co-ordination of all related activities. They should be good administrators and have strong organising ability.

TRAFFIC ASSISTANTS (M3B/34697/DU). Commencing salary £1,500. Applicants must possess a good working knowledge of port operating and quay management. They should be good organizers and have had sound practical experience in one of the following departments of a port or allied undertaking. (a) Port Management. (b) Quay Management (including control and employment of port labour and mechanical cargo handling appliances). (c) Cargo Documentation (including general superintendence and associated claims procedure). (d) Statistics, rates and charges.

TRAFFIC OFFICERS (M3B/34698/DU). Commencing salary £1,200/£1,400, according to qualifications and experience. Applicants must have a good knowledge of quay management and have had practical supervisory experience in one of the following activities of the Port industry. (a) Reception and clearance of general cargo through transit sheds using modern mechanical appliances. (b) Port railway operating. (c) Cargo superintendence. (d) Employment, distribution and training of port labour. (e) Warehousing. There are also vacancies on the same salary scale for officers with administrative or secretarial experience with Port Authorities.

ASSISTANT CHIEF ENGINEER (MECHANICAL AND ELECTRICAL) (M2A/40490/DU). Candidates should be Corporate Members of the Institution of Mechanical Engineers and/or the Institution of Electrical Engineers and have wide experience with equipment normally associated with Port operating activities, including electrically operated units, diesel shunting locomotives and motor transport. Some knowledge of Telecommunications and R/T an advantage. Age 35-45. Salary commencing at £2,000 per annum, according to experience.

DEPOT SUPERINTENDENT (M2A/40491/DU) to take charge of central construction depot. Applicants should have had previous experience of similar duties in a contractors plant yard and be well versed in organisational requirements and the maintenance of records. Experience in "blackgang" fitting an advantage. Commencing salary £1,550 per annum. Age 35-40 years.

Appointments will be for one tour of 10 to 18 months in the first instance thereafter, subject to satisfactory service, employment will be offered on a permanent basis and officers will be required to join the Authority's Pension Scheme or Provident Fund. It may be possible to preserve existing pension rights. Free first class return passages for officer and wife and assistance towards cost of up to two children's passages or an allowance in lieu thereof. Partly furnished quarters provided at rental of 10% of salary (max. £150 a year). Outfit allowance £60. Leave on full salary at rate of 7 days for each month's service. Free medical services. Car allowances payable and loans for car purchase in approved cases. Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, quoting the reference number shown against the relevant post.

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MINISTRY OF WORKS
CIVIL ENGINEERING DIVISION

VACANCY No. 1 ENGINEERS.

VACANCY No. 2 ASSISTANT ENGINEERS. A University Degree in Civil Engineering and/or Corporate Membership of the Institution of Civil Engineers, London. Salary on appointment from £665 for a graduate without experience to £1,242 per annum.

VACANCY No. 3 ENGINEERS' ASSISTANTS. General Certificate of Education (or equivalent) and substantial practical experience. Salary on appointment from £707 to £862 per annum.

VACANCY No. 4 TECHNICAL ASSISTANTS. General Certificate of Education (or equivalent) and preferably with engineering laboratory experience in soil mechanics or the testing of concrete and concrete aggregates, etc. Salary on appointment from £522 to £802 per annum.

VACANCY No. 5 DRAUGHTSMEN. Ordinary or Higher National Certificate and at least three years' experience at the drawing board. Salary on appointment from £665 to £1,042 per annum. Also vacancies in the New Zealand Forest Service.

MECHANICAL ENGINEERING DIVISION

VACANCY No. 6 ENGINEERS (MECHANICAL AND BUILDING SERVICES). Corporate Membership of the Institution of Mechanical Engineers, London. Salary on appointment from £892 to £1,402 per annum.

VACANCY No. 7 ASSISTANT ENGINEERS. A University Degree in Mechanical Engineering or Graduate Membership of the Institution of Mechanical Engineers, London. Salary on appointment from £665 to £862 per annum.

VACANCY No. 8 ENGINEERS' ASSISTANTS. Higher National Certificate in Mechanical Engineering and substantial practical experience. Salary on appointment from £707 to £862 per annum.

VACANCY No. 9 DRAUGHTSMEN (MECHANICAL AND BUILDING SERVICES). Ordinary or Higher National Certificate in Mechanical Engineering or equivalent. Salary on appointment from £665 to £922 per annum. Also vacancies for mechanical draughtsmen in the New Zealand Forest Service.

VACANCY No. 10 DRAUGHTSMEN (ELECTRICAL). Ordinary or Higher National Certificate in Electrical Engineering. Salary on appointment from £665 to £742 per annum.

Further information, conditions of appointment, and application forms obtainable on request from: High Commissioner for New Zealand, 415, Strand, London, W.C.2, quoting reference No. 3/74/106, together with the vacancy number stated above and mentioning this paper.

Completed applications **in duplicate** accompanied by **copies only also in duplicate** of two recent testimonials to be lodged not later than 31st December, 1954.

Appointing Officers will arrive from New Zealand in January, 1955, to interview suitable applicants.

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The new Berths are to be of length about 460-ft. and 600-ft., and the Transit Sheds are to be two-storied and of size about 440 x 160-ft. and 400 x 200-ft.

Drawings, Conditions of Contract and Specification may be obtained by Contractors from either The Chief Engineer, Commissioners for the Port of Calcutta, 15, Strand Road, Calcutta, 1, upon payment of a Tender Fee of Rs. 100, or the Commissioners' Consulting Engineers and London Agents, Messrs. Rendel, Palmer & Tritton, 125, Victoria Street, Westminster, London, S.W.1, upon payment of £7 10s. 0d. Such Tender Fee is not refundable.

Applications from Agents or other intermediaries will not be considered.

Tenderers are required, on submitting their tenders, to enclose with their specifications and drawings proof of their recent experience in constructing works of this type, together with an Engineer Appreciation covering the technical particulars of their offer. Tenderers are also required, before submitting their tenders, to deposit as Earnest Money Rs. 25,000 or £2,000 Sterling. Such Earnest Money is returnable on adjudication.

Tenders are returnable by 14th March, 1955. Quotations from the tenderers must be firm and remain open for a period of 4 months from the closing date.

The Commissioners do not bind themselves to accept the lowest or any tender and reserve the right to reject a tender without assigning any reasons.

(Sgd.) Chief Engineer,
CALCUTTA PORT COMMISSIONERS.

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Photograph by courtesy of Messrs. Braithwaite & Co. Engineers Limited.

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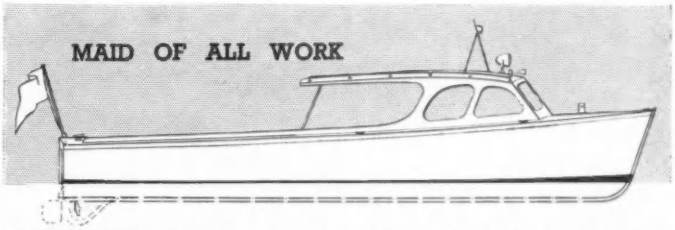

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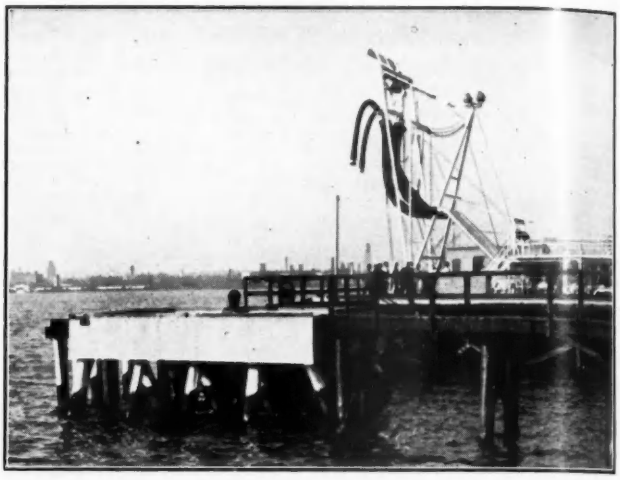

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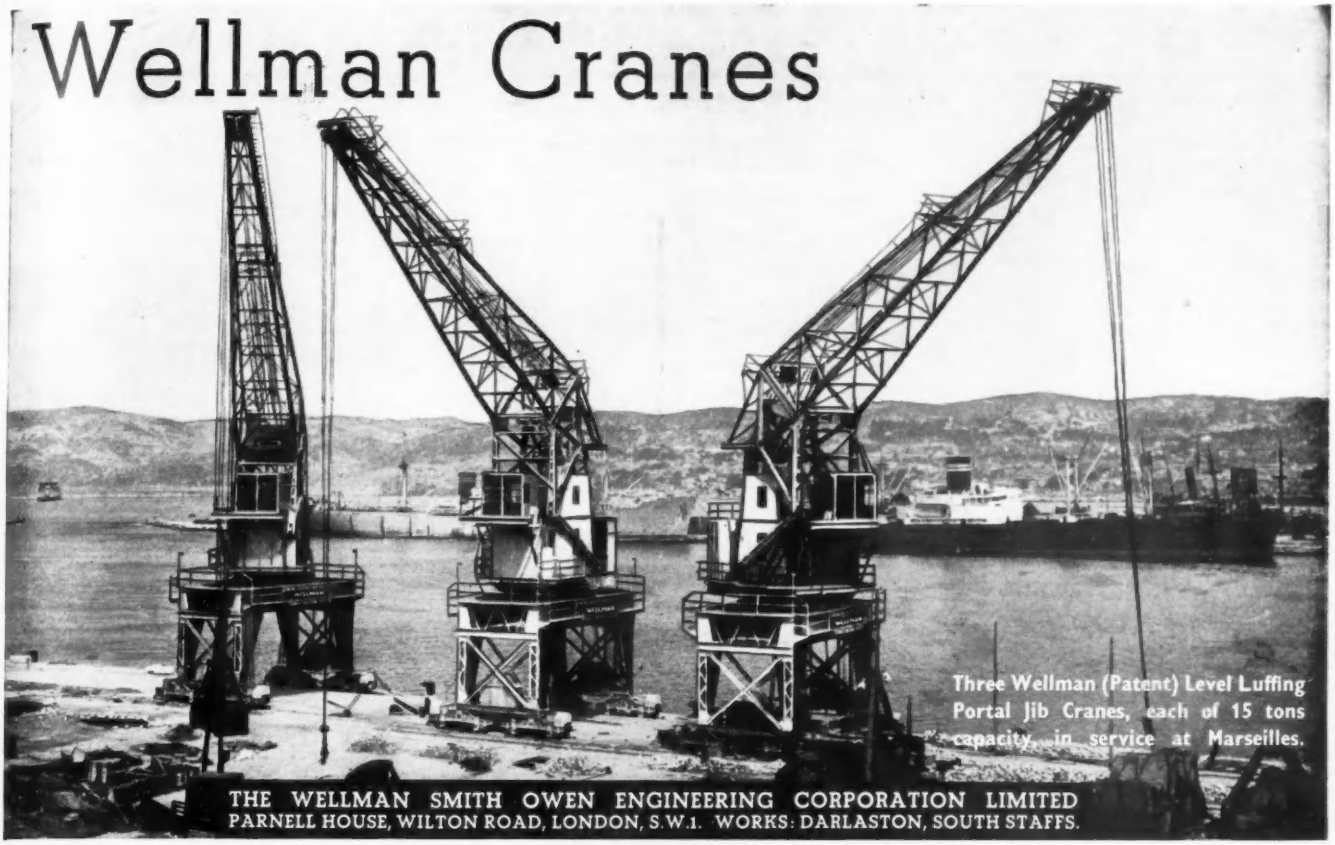

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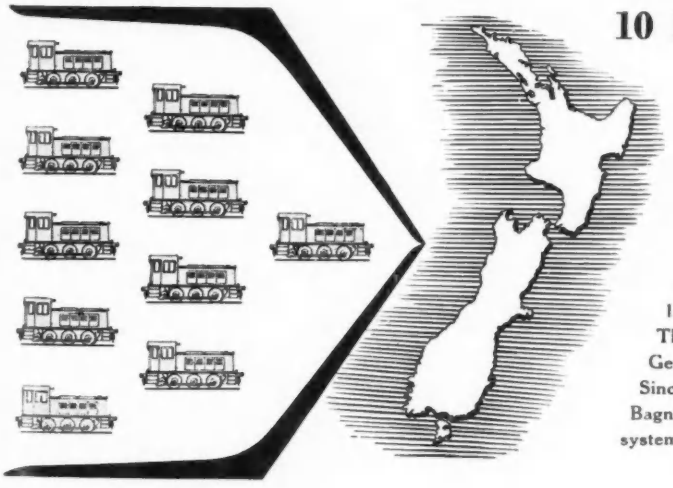

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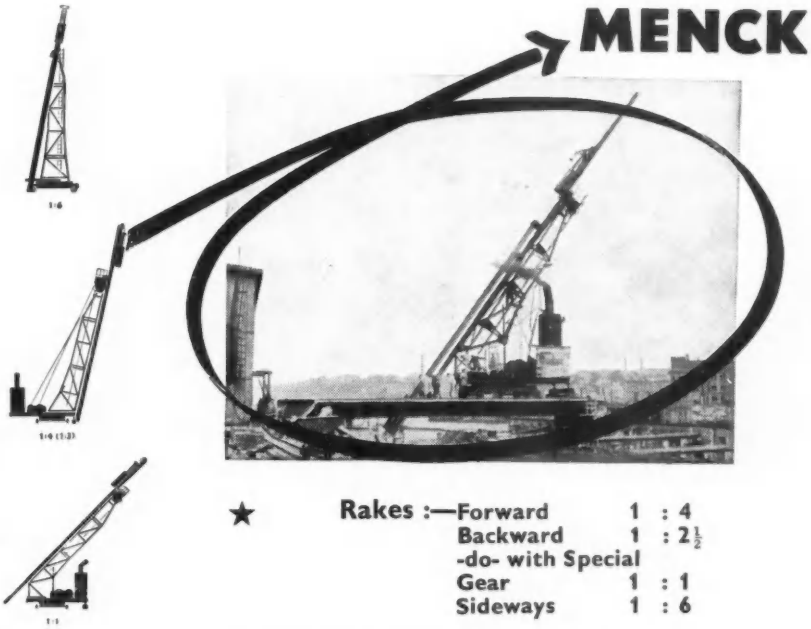

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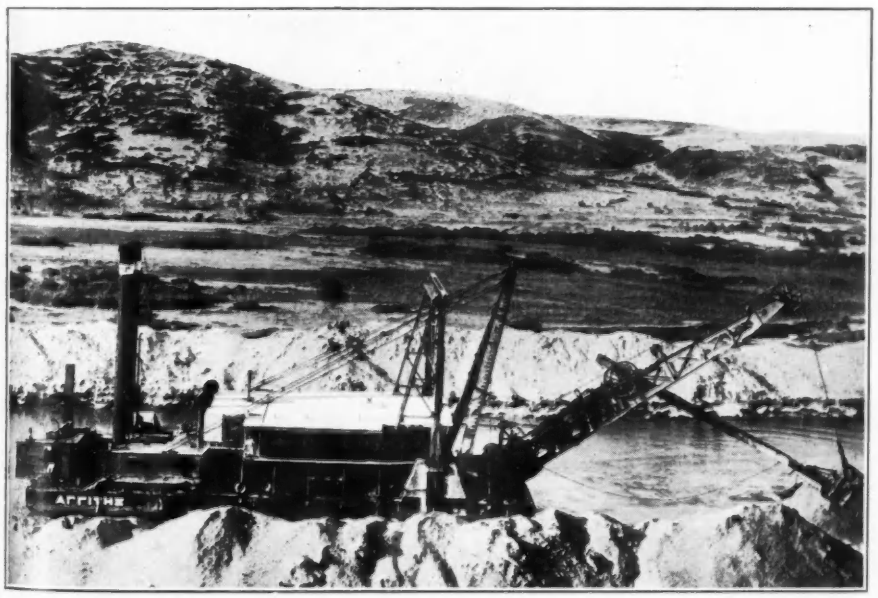

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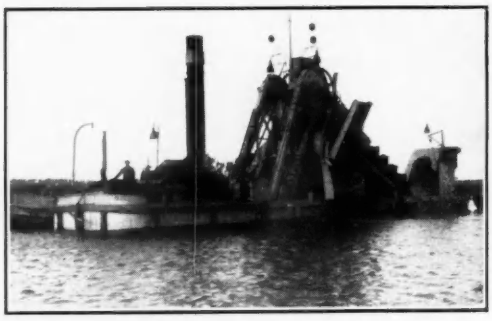

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